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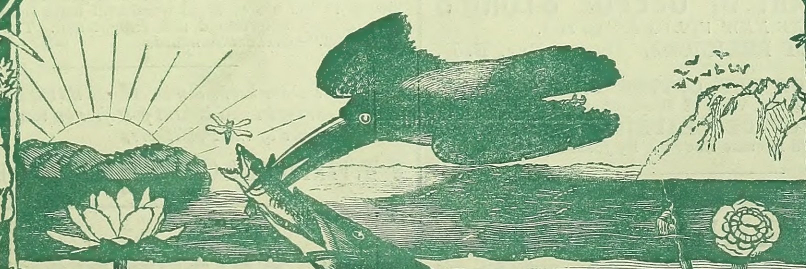

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BRITISH FRESHWATER MITES.

By C. F. George, M.R.C.S.

Axonopsis *complanata* Piersig was described and figured by Müller more than a hundred years ago, but since that time it has not been delineated, nor has any description been given, so far as I know, until that of Piersig in 1893. He gave it the name of *Axonopsis bicolor*, overlooking the fact that Müller had already figured, described and named it. In the same year Kœnike differentiated it, giving Müller's name of *complanata* and calling it *Brachypoda complanata*. According to present nomenclature it ranks as *Axonopsis complanata*. No doubt, if Koch had met with this mite he would have placed it in his list of Arrenuri, as in the case of other mites, which have very properly been removed out of that family.

I first found *Axonopsis complanata* about eighteen years ago, and have still by me the mounts I made at that time. It seems to be by no means a common mite, and I was pleased to be able to send Mr. Soar a living specimen last year. He has since that time found it himself, and I have to thank him for the figures accompanying this article. This mite is of an oval figure, truncated in front and only slightly convex; the skin is chitinous, and under the microscope it is seen to be beautifully marked, like an extremely fine coat of mail. It is very distinctly divided into three bands by colour, the first and last blue (Müller says "deep green"), the middle white and somewhat diaphanous; the Y-shaped portion is brilliantly white and opaque. In consequence of its chitinous skin it mounts well in balsam, and the beautiful transparent blue colour of the anterior and posterior bands is well brought out. Like most mites, it must be examined alive in order to appreciate its beauty. The palpi are small and weak and do not form pincers, as in *Arrenurus*. There are four genital discs on each side of the sexual opening. The eyes are black, and being placed well forward, and near the outer edge, are very conspicuous. On each side, and near the outer edge, is a depressed line, reminding one of that of *Arrenurus*, only in this case it is interrupted before and behind. The anterior epimera are also peculiar, projecting downwards and beautifully serrated on their outer edges in a manner I have not noticed in any other water-mite.

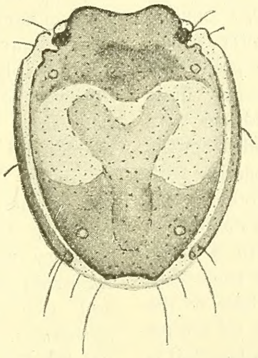

Fig. 1.

When once seen it is easily recognized and cannot readily be mistaken for any other mite. In Mr. Soar's drawing, fig. 1 represents the upper surface. He has not figured the palpi and legs, but in fig. 2 he shows these attached in their proper places.

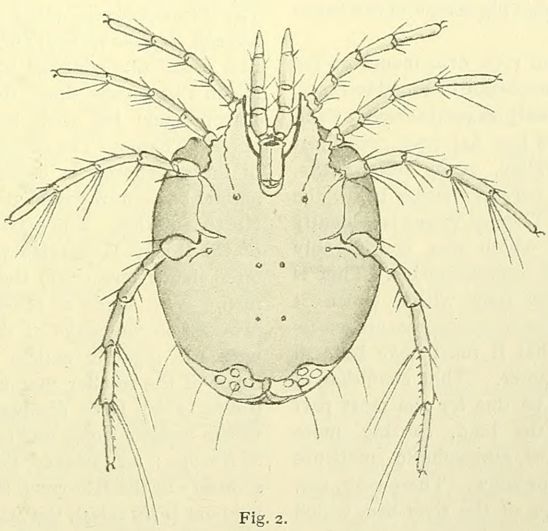

Fig. 2.

Axonopsis complanata *Piersig*.
Fig. 1.—Upperside. Fig. 2.—Underside.

The deep green, "saturate viridis," mentioned by Müller, is no doubt produced by the yellowish contents of the body viewed through the transparent blue of the chitine.

The diagnostic characters of *Axonopsis complanata* are: (1) the three basal joints of the first pair of legs are not thicker than the others; (2) the body skin hard (chitinous), like a coat of mail; (3) all the tarsi furnished with claws; (4) body wider than high; (5) four genital cups on each side of the genital cleft. The size is: length, 0·44 mm.; breadth, 0·32 mm. Localities at present known in Britain: Lincolnshire, and Staines, Middlesex. I do not know that any other species of *Axonopsis* has yet been discovered.

Kirton-in-Lindsey.

PLEISTOCENE DRIFT OF THAMES VALLEY.

By J. P. Johnson.

THE series of old fluviatile deposits which border the Thames and its tributaries, known collectively as the river drift, consist chiefly of gravel, often mixed with interbedded lenticular patches of sand, and occasionally almost entirely replaced by sand. In some places there is a capping of loam, and below London thicker masses of a similar character occur, alternating with gravel and sand. The great bulk of the gravel is composed of subangular flints derived from the adjacent chalk. Mixed with these are rounded flint pebbles washed from the Eocene strata of the neighbourhood, together with occasional pebbles of quartz, slate and other rocks. When the gravel rests directly on the chalk it is generally mixed at the bottom with a large proportion of chalk rubble, which is sometimes consolidated and forms a thin solid base to the drift. The gravel is rarely more than six metres in thickness; the loam is usually much less, but is occasionally more. In the neighbourhood of Hornchurch, in Essex, these deposits rest upon the moraine material of ancient glaciers, and are hence locally post-glacial.

These accumulations of river drift mount up the sides of the valley by a succession of broad terraces, but sometimes they lie evenly on gentle slopes. Each terrace forms a more or less flat tract, often cut through by the main valley, or by side valleys, sufficiently deep to lay bare the strata below the gravel. The drift of the Thames Valley is evidently the deposit of a river which was considerably larger than its modern representative. This is shown by the far wider tract within which it flowed, whilst the comparative coarseness of its deposit would indicate that it must have been of a more torrential character. That condition of size and power would be due for the most part to greater height of the land, causing more abundant condensation of atmospheric moisture and heavier fall of rain or snow, There may, too, have been a steeper slope of the river-bed, which would give more power of transport. Such a raising of the land would make our island part of the main continent of Europe, as it undoubtedly was at that period.

The river drift of this region is very fossiliferous in places. All the Mollusca represented, with the exception of three, *Unio littoralis*, *Corbicula flaminalis*, and *Paludestrina marginata*, exist at the present day in this island, whilst those three are now found elsewhere. The remains of the Vertebrata, however, are the most interesting. Some, which are represented, still inhabit this country, such are the fox (*Canis vulpes*), the otter (*Lutra vulgaris*), the stag (*Cervus elaphus*), and the horse (*Equus caballus*). This last was not then the fine large beast which the care and training of man has produced—indeed it was scarcely larger than a donkey. The wild cattle of Chillingham Park may perhaps be the last surviving descendants of *Bos primigenius;* but if so, they are considerably reduced in size. The majority, however, of the animals which were contemporaneous with the primitive men who then roamed by what is now the Thames Valley, are no longer inhabitants of this country. Some are extinct, though others survive elsewhere. Amongst those species included in the former category may be mentioned three rhinoceroses, *Rhinoceros antiquitatis*, *R. leptorhinus*, *R. megarhinus*, and two elephants, *Elephas antiquus*, and *E. primigenius*. The last-named was present throughout the Glacial epoch, being well protected from the severe climate by its woolly coat. The present distribution of the survivors is of great interest. The hippopotamus (*Hippopotamus amphibius*), the hyaena (*Hyaena crocuta*) and the lion (*Felis leo*) are now practically confined to the African continent, but in Pleistocene times these three roamed over Europe, and left their bones in the silt of the ancient Thames. The occurrence of *Ovibos moschatus* in these deposits is especially noteworthy, this animal being now confined to the arctic regions of North America. The grizzly bear (*Ursus horribilis*) of the Rocky Mountains was here, and doubtless often struck terror into the breasts of the savage men. Vast herds of reindeer (*Rangifer tarandus*) browsed on the banks of the Thames in company with the gigantic extinct deer (*Cervus giganteus*). Some of the smaller mammals, such as the beaver (*Castor fiber*), have disappeared from these isles within historic times, and several linger on in parts of Europe: for instance, the wild-boar (*Sus scrofa*), a variety of the European bison (*Bison bonasus*), the wild-cat (*Felis catus*), the wolf (*Canis lupus*) and the brown bear (*Ursus arctos*). Such was the remarkable assemblage of animals which confronted primitive man in the Thames Valley. Many other fierce carnivora were associated with him in Britain at this time, but I have only mentioned the more important of those animals whose remains have actually been found within this restricted area.

Man's presence is fully indicated by the abundance of his rudely-made flint implements, though his bones are extremely rare. The implements

found in these deposits are not all of the same age. Some are large and roughly fashioned: they are covered with a thick ochreous crust, and are always abraded. Others are not in the least worn, and are as sharp as when first made. Occasionally one comes across examples of the older type which have been neatly retrimmed by later tribes.

An extremely interesting feature of these deposits is the occurrence in one or two places of the old land surfaces on which these primitive men manufactured their tools. These surface planes are strewn with flint flakes and the cores from which they were struck. Specimens can be seen in the Natural History Museum at South Kensington in which the flakes have been collected and replaced on the core, thus showing the method employed in detaching them. So well defined are these old land surfaces that in some instances the ancient cracks which were produced when the sun's rays beat down on the soft clay thousands of years ago have been preserved, having been filled up and covered by fresh drift. They are sometimes strewn with branches, twigs, and even leaves. Some of the wood has shown possible evidence of artificial pointing, but its friability and bad state of preservation prevent an absolutely certain verdict.

I have already alluded to the scarcity of human bones in these old river deposits. Their conspicuous absence is not confined to the drift of the Thames Valley, but is common to all the Pleistocene drift of this country. Only two undoubted discoveries are on record. In 1882 a fragment of a human skull was found in a red loam filling a pocket in the chalk, near Bury St. Edmunds. The discoverer says there can be no question as to the great antiquity of the fragment, and that the deposit of red loam in which it was found must have been formed long anterior to the complete excavation of the valley of the Linnet to the south. In adjoining pockets two grinders of *Elephas primigenius* were found, and four flint implements. The discoverer considers this human fragment to have belonged to an undersized, poorly-developed individual of middle age, probably of the female sex (1). This specimen has unfortunately been destroyed.

The second and far more important discovery was recorded in 1895, in the "Quarterly Journal of the Geological Society." The find consisted of the exposure some years previously of a complete human skeleton in the Pleistocene river drift at Galley Hill, Northfleet. The bones were found at a depth of two metres in a stratum of gravel about three metres thick. This bed of gravel, which rests on the chalk, forms part of the high-level terrace of the neighbourhood, and is situated at a height of almost twenty-seven metres above the present Thames. Many palaeolithic flint implements have been exhumed from this deposit at different times. There is no doubt as to the remains being *in situ*, for the skull was seen in position by one gentleman and the limb-bones were dug out by another. Moreover, they were so fragile that it was quite impossible for them to have been placed there by the workmen. The skeleton does not seem to have been buried in the gravel at a date posterior to its deposition. The two people who saw the bones in the face of the gravel, and who were also well acquainted with this pit, are very positive in saying that there was no evidence whatever of the gravel above the remains having been disturbed, as it must have been if this were indeed a burial subsequent to the accumulation of the gravel. The skull is remarkable for its great length, the cephalic index being calculated at ·64. It has prominent supraciliary ridges and a receding forehead. The limb-bones present no marked peculiarities and indicate a stature of but little over one and a-half metres, or rather less than five feet.

Whilst this article treats specially of the Thames Valley deposits, it may be pointed out that these observations apply equally to several rivers, such as the Ouse, the Lea, the Colne, and others.

The Glen, Glengarry Road, East Dulwich.

(1) "Journal of the Anthropological Institute," vol. xiv.

NATIONAL ANTARCTIC EXPEDITION.

SIR Clements R. Markham, as President of the Royal Geographical Society, has appealed to the numerous wealthy Englishmen with scientific tastes to contribute to the formation of a fund to equip a vessel for an Antarctic expedition. At the present time the Government is unable to send out such an enterprise, but the Admiralty will aid by a loan of instruments and otherwise. The Royal Society will also assist, though perhaps not financially. The sum required will probably amount to about £100,000, towards which the Royal Geographical Society and Mr. Alfred Harmsworth have each contributed £5,000. Other subscriptions have also been received by the Society, so we have no reason to doubt that the total sum will soon be forthcoming. From a scientific point of view the expedition ought to be of the utmost value, especially as it is probable that it will work in conjunction with a German exploration party that is expected to be within the Antarctic Circle about the same time that is to say, during the year 1900. There are many facts of scientific importance yet to be cleared up in connection with the Antarctic relating to both physical and natural science. These will be of inestimable value to navigators in the southern hemisphere.

BIRDS WASHED OVER NIAGARA FALLS.

By Rev. R. Ashington Bullen, B.A., F.G.S.

THROUGH the kindness of Mr. David Boyle, Curator of the Archaeological Museum, Toronto, Ontario, I have received the following list of birds which are washed over Niagara Falls. It has been compiled by Mr. Roderick Cameron, who has also added an account of how the birds are caught. The list, so far as I can ascertain, has never before been published: — Whistling swans (*Cygnus americana*), common brant-geese (*Bernicla brenta* Stephens), Canada goose (*B. canadensis* Boie), mallard ducks (*Anas boschas* Linn), pintail ducks (*Dafila acuta* Jenyns.), American widgeon (*Mareca americana* Stephens), American green-winged teal (*Nettion carolinensis* Baird), and other varieties, American eider-duck (*Somateria spectabilis* Leach), American black-scoter or sea-coot (*Pelionetta perspicillata* Kaup), American white pelican (*Pelecanus tachyrhynchus*), shoveller, or spoonbill duck (*Spatula clypeata* Boie), gray duck, or gadwall (*Chaulelasmus streperus* Gray), black dusky-duck (*Anas obscura* Gmelin), wood-duck (*Aix sponsa* Boie), canvas-back duck (*Aythya vallisneria* Bonaparte), red-head duck (*A. americana* Bonaparte), blue-billed duck, or scaup (*Fulix marila* Baird), whistle-wing duck (*Bucephala americana* Baird), golden-eye duck (*B. islandica* Baird), buffle-head or butter-ball duck (*B. albeola* Baird), eider or spectacled duck (*Somateria spectabilis* Leach), scoter, or surf duck (*Oidemia americana* Swainson), saw-billed duck ([1]), mud-hens (*Fulica americana* Gmelin), and mud-hens (*Rallus crepitans* Gmelin), sheldrake (*Mergus americanus* Cassin), red-breasted merganser (*M. serrator* Linn.), hooded merganser (*Lophodytes cucullatus* Reichart), common cormorant *Graculus carbo* Gray), ruddy duck (*Erismatura rubida* Bonaparte), summer duck ([2]), coween duck ([3]), great northern diver, or loon (*Colymbus torquatus* Brunnich), muffle-head diver (*C. arcticus*). The scientific names are mainly taken from Samuels' "Birds of New England and Neighbouring States."

Mr. Roderick Cameron is Superintendent of Queen Victoria Niagara Falls Park. He writes: "I may say that all the birds above mentioned come over the Falls at all times when on the river above the Falls, and that is in the autumn and in the spring, when they are migrating southward in the former and northward in the latter. The swans are only seen in the spring; I once saw about fifty in one flock. The pelicans are seen in the autumn only, and very few of them. There is one duck that comes over the Falls in the day-time only and generally about midday, viz., the little "butter-ball." If the day after a very dull cloudy day happens to have bright sunshine, it seems to blind them: they come over the falls in large numbers, and they are very good eating. About a third of them are killed in coming over the Falls, but the rest, being in splendid condition, are unhurt. The other kinds of duck come over the Falls as a rule with heavy fogs, or on dark stormy nights, especially during heavy rain or snow. I have seen as many as 500 blue-billed ducks captured inside three hours, and also twenty to thirty wild geese got in one night. In autumn of 1896 I took as many as seven myself at one time. Geese come over in day-light, in the morning. The ducks play on the river near the rapids above the Falls after coming from the far North. Being tired they get into the rapids and will not rise; after their plunge over the Falls they sail down the river a little and then rise and attempt to fly back. In doing so they get into the thick spray, fly against the Falls and come along again, but this time dead. A belief of mine is that the ducks get their feathers wet with a heavy rain and do not like to fly and so go over. Otherwise they get into the rapids, and, facing up stream against the current, try to rise and fly back, but the current drives them on until they are over. When the water is low in the river or rapids I have seen them get up and fly back, but I never saw this happen when the river was high.

"Taking all these things into consideration we know just when to go and hunt for ducks with reflecting lanterns. The ducks are attracted by the light and the dogs then catch them. The ducks and geese are not nearly so plentiful as they were a few years ago. Owing, probably, to their breeding places being disturbed by immigrants settling there, the ducks and other birds seem to be taking another direction. I do not think they are getting wiser and so keeping away from their great danger at Niagara Falls."

The Rectory, Little Stukeley, Huntingdon.

[This list is one of considerable scientific interest, showing that though the ancestors of these birds have probably been killed in the same manner as those above indicated for thousands of years past, they have not learned to avoid the danger of Niagara and other falls on the great American rivers. Can any of our Canadian or general readers give us particulars of similar occurrences at other falls, such as that of Montmorency, by the Island of Orleans in the St. Lawrence River?—Ed. S.-G.]

(1) (3) I cannot identify these species scientifically.—R.A.B.
(2) Samuels gives this as *Aix sponsa* Boie.

SOME NEW PHYSICAL APPARATUS.

By James Quick.

I.—EXPANSION OF SOLIDS.

THE continually increasing work done during the last two or three years in practical physics, and the number of physical laboratories constantly being equipped in our secondary schools and technical institutes, have necessitated considerably more attention being paid to the requirements of this subject and to the methods followed by the various science masters in the country. As, however, a different class of students is found in schools to that in university and other colleges, it is necessary to bring before them specially devised apparatus, arranged in such manner that although capable of accurate quantitative results, it will not present any complicated ideas. That is to say, there should be only one difficulty — one fresh question confronting the student at a time, and then his previous instruction ought to have supplied all knowledge required, except the particular object of the experiment. This difficulty is very frequently met with by teachers in the early part of the session, when giving students experiments to perform in thermal expansion of solids; because some of the present methods, such as those requiring the projection upon the screen of the ends of the rods under consideration, or the viewing of them through a telescope, necessitate grasping the idea of magnifying powers, and this is a difficulty to some students. These methods also generally require much setting up and a good deal of time, which, when one has a full course of work to get through, is to be regretted, and frequently leads to the experiment being struck out altogether. Mr. F. C. Weedon's design (1) completely overcomes these difficulties, as it does not depend upon any knowledge of optics, but simply upon reading direct, by means of a pair of good micrometers, of the expansion of the rod in question through a range of temperature, precautions being taken to prevent radiation and consequent expansion or contraction of any surrounding part of the apparatus.

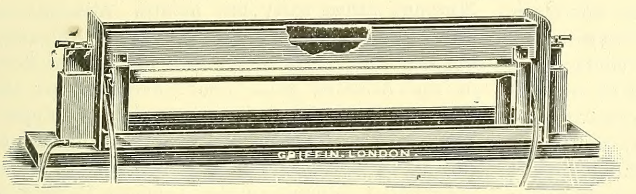

Fig. 1.—Apparatus for Testing Expansion of Solids.

The only knowledge, therefore, assumed as possessed by the student is the principle of the vernier — an elementary portion of mensuration that is instilled, at the very outset of a practical physics career. The construction of the apparatus is seen from fig 1. It consists of a long zinc trough, in which, upon struts, is placed the rod, one metre long, the coefficient of which is to be measured. A burner is supported underneath the trough, running the whole length of it, and provided with a double set of holes and two inlet gas pipes, so that the water contained in the trough may be heated to boiling-point. The ends of the trough have stuffing boxes, through which pass short bits of glass rods, abutting on the one side against the ends of the rod and on the other against two delicate micrometer gauges which are supported in two firm cast-brass clamps fixed to solid teak blocks from the base. A metal screen at each end, faced inside with asbestos, prevents heat radiating to the micrometer gauges, thus eliminating any error due to their expansion. The supports for the trough, burner, etc., are placed in a cold-water trough, provided with inlet and exit pipes, and running the whole length of the base, which is

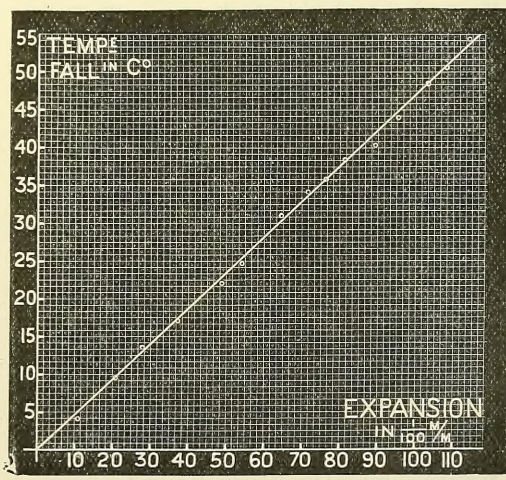

Fig. 2.—Expansion of Solids, Specimen Curve.

(1) Mr. F. C. Weedon, of Alleyn's School, Dulwich, has got over the difficulty in his experiments upon the expansion of solids, by the design of the present apparatus in use there, which should be a really serviceable addition to a physical laboratory.

substantially made of teak. This cold-water bath thus prevents any expansion of the base and supports due to heat radiated from the burner and the hot-water trough above (²). The method of working the apparatus is as follows: the micrometers having been screwed back sufficiently far to allow the maximum expansion of the bar to take place freely at the highest temperature, the burner, supplied with gas at both ends, is lit and the water in the upper trough raised to as near boiling-point as possible. When this maximum temperature is attained, one micrometer is screwed in until the screw comes in touch with the short glass end-pieces. The other micrometer is now screwed up very carefully until the hand feels that the screw is just in contact with the other glass end-piece. After one or two trials no difficulty is experienced in screwing to just the point of contact and no more; the means of several sets of readings taken to test this point differing only to an extremely slight extent from the value of any one single reading. The reading on this second micrometer is then taken simultaneously with the temperature of the water in the trough, which temperature is obtained by means of a thermometer placed anywhere in the water; the latter being constantly stirred from end to end with any convenient stirrer. The gas is then turned off, and pairs of readings on the micrometer and thermometer are taken together as the temperature gradually falls.

It may at first sight be thought that there is no actual need for the second micrometer, but as has been above stated, the instrument has been designed for actual measurements by the students themselves, especially in large laboratory classes, where they work either in pairs or threes. In these cases, therefore, if the two micrometers are worked, each student is actually employed in taking readings. It is also essential that an apparatus of this description should exemplify the principle in all detail, as cases have occurred with junior students in which, if the second end of an expanding rod abuts against a rigid support, they have formed the idea that the rod only tends to expand in its free direction, not all ways.

Plotting the readings obtained as above, upon curve paper, a very uniform straight line is produced with this apparatus, and fig. 2 represents a specimen curve actually obtained for a rod of brass. Calculating the coefficient of expansion from this, it will be seen that the percentage error is very small.

Considering then the practical requirements in heat laid down in the syllabus of the Science and Art Department, the University of London and other bodies, in which the expansion of solids occur, the present apparatus should prove a very useful and trustworthy adjunct. Thanks must be given to Messrs. J. J. Griffin and Sons, of Sardinia Street, Lincoln's Inn Fields, W.C., who are manufacturing this apparatus, and who have kindly lent the above blocks for illustration.

(²) The efficiency of the instrument almost entirely depends upon the accuracy of the micrometer gauges, those used are thoroughly well made, and are capable of reading to one-hundredth of a millimetre.

(To be continued.)

THE "OCEANA" EXPEDITION.

WITH the object of exploring the intermediate vertical zone of the Atlantic Ocean, the "Oceana" Expedition, organized by Mr. George R. Milne Murray, F.R.S., Keeper of the Botanical Department of the British Natural History Museum, sailed early last month. Although so much has been accomplished in investigating the fauna and flora of the deepest abyssal floor of the Atlantic, great doubt exists as to the inhabitants of the region occupying the depths below 350 fathoms and above the influence of the actual bottom of the ocean. In a recent presidential address to the Linnean Society of London, Dr. Albert Günther, F.R.S., urged that further attempts should be made to explore the middle zone with specially constructed apparatus. Now this is to be attempted by Mr. Murray, assisted by a scientific staff, including Messrs. Vernon H. Blackman, B.A., and J. Walter Gregory, D.Sc., of the Museum staff; also Mr. J. E. S. Moore, Dr. Sambon, and Mr. Highley, the last-named gentleman as artist. The museum authorities are lending their aid by granting to Mr. Murray and his colleagues the necessary leave of absence. Financial assistance has been contributed from various sources, such as the Royal Geographical Society, the Drapers' Company and the Fishmongers' Company. Mr. Murray has chartered the "Oceana," which has been fitted out by the Silvertown Telegraph Cable Company, whose officials entered into the spirit of the expedition and gave every possible assistance. Work was to commence at the outer edge of the 100-fathom line off the coast of Ireland and extended for some ten degrees westward. The apparatus includes sounding-lines to over 2,000 fathoms and a series of thirty-eight tow-nets. Other observations will be made in regard to temperature, pressure and examination of the floor of the ocean, so as to get the greatest possible evidence of the vertical distribution of life inhabiting the Atlantic in the places sounded.

One cannot overestimate the public spirit and enterprise of Mr. George Milne Murray, shown in inaugurating this scientific expedition, from which we trust the results may be equivalent to its importance. It is a satisfaction to know that the conduct of the investigations is directed by men of known scientific training and ability.

THE PRESENT EVOLUTION OF MAN.

By G. W. Bulman, M.A., B.Sc.

AMONG evolutionists generally there seems to be a wide-spread feeling of regret that, as regards the human race, natural selection has ceased its beneficent work. The artificial conditions under which we live, and the preservation of the unfit, have swamped its efforts for the improvement of man. Thus, Dr. Wallace tells us that in one of his latest conversations with Mr. Darwin, the latter expressed himself very gloomily on the future of humanity, on the ground that natural selection had no place in modern civilization, and that the fittest did not survive. Mr. Reid, however, points out the welcome fact that we are still evolving in certain definite directions: we are acquiring immunity against diseases. The idea has much to recommend it. Immunity against disease is an unquestionable advantage in the struggle for life; and doubtless differences in susceptibility to infection occur in different individuals. This is all the theory of natural selection requires for the evolution of a disease-proof race. The degree of protection should go on increasing to absolute immunity. For to however great a degree it had gone, further immunity would always be an advantage, and there would always be variation in the direction of increased immunity. Such is the pleasant prospect set before us as we open the pages of Mr. Reid's "Present Evolution of Man." Yet on reading further we find that the author himself does not take quite such a rosy view. His belief in the powers of natural selection are not robust enough to allow him to prophesy an absolutely disease-proof race. Immunity will only, he thinks, reach a partial perfection.

It is difficult to understand why natural selection should thus stop short of absolute perfection. Darwin himself had greater faith in its powers; for when a scheme for evolving a disease-proof potato was proposed, he wrote: "Mr. Torbitt's plan of overcoming the potato-disease seems to me by far the best which has ever been suggested. It consists in rearing a vast number of seedlings from cross-fertilized parents, exposing them to infection, ruthlessly destroying all that suffer, saving those which resist best, and repeating the process in successive seminal generations." If natural selection were indeed the potent force it must have been to do the work required of it by evolutionists, it would, doubtless, ere this have produced both a disease-proof man and a disease-proof potato.

The special subject which gives the title to Mr. Reid's book is not met with, however, till we reach the second part. In the first part we have a sketch of evolution in general—practically a defence of Weismann against Mr. H. Spencer and others. It may seem to some superfluous thus to go over the elementary principles of evolution in a work of this kind. Yet, in these days of much divergence of opinion on the theory, it becomes necessary for each writer to state to which school he belongs, or, to be more accurate, to explain the principles of his own school. So, then, Mr. Reid defines his own position as to the great theory of natural selection. The general impression left by a perusal of his pages is that his arguments are more convincing when directed against the transmission of acquired characters than in showing how evolution can take place without it. Indeed, the position seems to be this, that since acquired characters *are not* transmitted, and since evolution *has* taken place, it must be possible without such transmission. An outline of the process of evolution is given. Like others, Mr. Reid seems to think that, given the known abundance of variation, and the admitted intensity of the struggle for existence, evolution of species must follow as a necessary consequence. The possibility that variation and the struggle for existence, be they ever so widespread and intense, might not be of the kind required is ignored. Yet, given variation which is strictly limited in amount, and a struggle for existence that is largely indiscriminate, evolution of species does not follow as a necessary consequence. The weak point, however, in the present position of the theory is that these two essential factors, variation and the struggle for existence, have not been shown to be of the nature required. Mr. Reid gives no assistance on this point.

As a matter of fact both these factors may have been such as to render evolution by natural selection impossible. Variation to meet the demands of the view must be, or at least have been, in practically every direction; for it must have covered the difference between the first simple form of life and every species of the higher forms which have ever existed. It must also be unlimited in amount. Now it has never been shown that variation is of this nature, and there are several considerations tending to show that it is not. Taking all the facts into consideration, the balance of evidence seems to indicate that variation is not of the nature required. Again, it is conceivable that the struggle for existence might be even severer than has been demonstrated, and yet not tend to preserve slight individual differences, for it might be largely or altogether indiscriminate. Here, again, facts tend

to show that the struggle is largely so, and that those which survive are the most fit only in the sense that those who survive in a railway accident or earthquake are the fittest.

Mr. Reid brings forward many arguments against the transmission of acquired characters—that is, against the view that acquired characters produce exactly the same characters in the offspring. From the force of these arguments there seems to be no escape; but in a subsequent chapter it is admitted that acquired characters may, and must, influence the offspring, though not to reproduce the effects produced on the parent. Yet it is hard to resist the conviction that some of the arguments adduced in the former case tell equally against the latter view.

The persistence of many extremely low forms of life, while others have advanced to such a degree of complexity, has been often felt to be a difficulty. To explain how certain species have continued in their low estate, in spite of the evolution around them, Mr. Reid brings forward the following somewhat misleading analogy: "The upward march of life from the earliest beginnings may be compared to that of a horde of men leaving their old habitations and entering new lands; travelling ever forwards, but ever sending out branch swarms that part from the parent horde, never to reunite with it, and ever leaving some of their members behind on the way, some of whom may journey backwards. . . . . . The lowest, or in other words, the least differentiated and specialized, forms of life may be compared to those members of the horde that stayed behind in the original habitat, the intermediate forms to those that halted and settled by the way, and the highest forms to those that journeyed till they reached the farthest limits of the wanderings." This analogy is misleading; for being left behind in the struggle for life means extermination, according to the principles of natural selection. The strict analogy between the production of species in nature and the production of varieties artificially, is insisted upon. Existence of domestic breeds seems to be looked upon as proof that evolution by natural selection can take, and has taken, place in nature; but we are not told how the part played by man in isolating his breeds and preventing crossing is effected in nature. The instability of domestic varieties as compared with the stability of natural species seems also to be left out of consideration. That man, by carefully mating like with like, as well as selecting, can produce an unstable variety, is no argument that selection alone in nature can produce a stable species.

On reaching Part II. we come to Mr. Reid's views as to what natural selection is now doing for man, and which gives the work its title. When Ceres wished to benefit the sick youth Triptolemum, she —his mother's back being turned—set him down in the glowing embers of the fire to burn out his mortal parts. According to Mr. Reid, natural selection is playing the part of Ceres to the human race, by exposing it to the risk of infection, and gradually weeding out the susceptible part. Susceptibility to disease is a variable quality: those who have it in the highest degree will be the least fitted to survive, and will therefore be gradually weeded out. Thus natural selection will tend to produce a disease-proof race.

Let us then examine a few of Mr. Reid's facts and arguments. In regard to malarial fevers and other diseases of hot countries which are so fatal to Europeans, it is pointed out that the natives enjoy a certain immunity. It is, therefore, claimed that the race is being evolved in the direction of immunity, continual exposure to infection weeding out the more susceptible. Careful examination is requisite before we can accept the fact as evidence for the theory. Thus it may well be that the adults are less susceptible because they have had the disease in childhood. Mr. Reid himself points out that the natives themselves are more susceptible in the early stages of life. Again, it is quite possible that the native manner of life is such as to help them to resist the disease. When due allowance has been made for these, and possibly other factors, it will, perhaps, scarcely be necessary to invoke acquired immunity to account for the facts.

Again, among ourselves, many diseases have certainly diminished, and this appears to favour the view that the human race is acquiring immunity. For this reduction improved sanitary arrangements, and the progress of medicine claim a large share. In the case of small-pox, we have three claimants to the chief share. The improvement, say the vaccinators, is due to vaccination; it is due to improved sanitation say the anti-vaccinators; while Mr. Reid claims it for acquired immunity. When due allowance is made for all other probable or possible causes, it is difficult to say how much is left for acquired immunity. Mr. Reid has not even attempted the task.

Much stress is also laid upon the fact that uncivilized nations suffer more severely from the diseases introduced by civilization than those civilized nations that have introduced them, and which have themselves acquired immunity. This severer suffering is supposed to imply that to the natives it is a new disease, and they have not been evolved against it. Mr. Reid does not, however, seem to have set himself to inquire whether the diseases are really new to them or not. Is there evidence, for example, to show that consumption is a new disease to any uncivilized nation? Again, Mr. Reid ignores the fact that the greater mortality among savages from the so-called diseases of

civilization may be partly, or altogether, due to ignorance of the right method of treatment.

On one point Mr. Reid confesses that he has regarded it as such a foregone conclusion that the evidence would be in his favour, that he has not been very eager in collecting it. We think he has perhaps unconsciously followed the same method on other occasions. Really, all through this part of his subject Mr. Reid ignores the fact that there are other causes capable of producing the greater part, if not the whole, of the effects he ascribes to evolution against disease.

With regard to drunkenness a similar line of argument is taken. The human race, it is supposed, has undergone evolution with respect to strong drink. During countless generations those individuals with the strongest craving for it have been eliminated, and those which had not the craving survived. If this were so, then those nations which have been longest familiar with alcohol and suffered most from it in the past should now be the soberest. Mr. Reid does contend that there is evidence that this is so. Thus he points out that nations like the Italians, Spaniards, etc., who have longest been familiar with alcohol, suffer the least from it; those which have been familiar with it for a shorter time, like the English, suffer more; while those who have been recently introduced to it, like the various uncivilized nations of to-day, suffer most. Admitting that Mr. Reid is right in his arrangement of nations according to their comparative drunkenness, there remains the question of the length of their acquaintance with alcohol. On this point it seems extremely rash to assert that Italians and Spaniards have used alcohol longer than the English. It may be so, but what is the evidence? Mr. Reid's peculiar views, and the greatness of his faith in natural selection, lead him to propose a startling remedy for intemperance. The efforts of temperance reformers and teetotalers, we are told, have hitherto been all in the wrong direction, they have been positively playing into the hands of the enemy they are supposed to be fighting. Mr. Reid, in effect, says, if you restrict the sale of drink, reduce the number of public-houses, remove temptation out of the way of the drunken, or do anything to deprive people of the opportunity of readily obtaining drink, you are undoing the beneficial work of natural selection. You are depriving nature of the instrument with which she is preparing a sober race. Let those who have the craving have every opportunity for gratifying it, and they will be weeded out by natural selection. Finally, a race without any such craving will be evolved. Such is the truly heroic remedy proposed for intemperance by Mr. Reid, in conformity with his general views on the present evolution of man; but the thought arrives, if natural selection is able to eliminate the drunkard, how does it happen that it has permitted his evolution? For it is one of the canons of evolution that the struggle for existence will not allow the development of any injurious quality.

On the whole, it is doubtful whether there is any evidence to show that man is being evolved in the direction of immunity against disease and alcohol. The facts adduced by Mr. Reid in support of his views can be otherwise more rationally explained.

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BRITISH INFUSORIA.

By E. H. J. Schuster, F.Z.S.

(*Continued from page* 139.)

Part V.—Ciliata Hypotricha.

In the order Hypotricha we can observe a very high degree of differentiation. The vibratile cilia, which we find forming an even and regular covering of the body in the Holotricha, and which are more highly organized in the Heterotricha, inasmuch as a special adoral band has appeared, reach in the Hypotricha their highest point of differentiation. They are here entirely absent from the dorsal surface of the body, and are present on the ventral surface, in the lower forms as plain rows of primitive cilia, in the higher forms as stiff bristles, claws, styles, and feather-like excrescences. With the aid of these the animal is not only able to swim, but also—a much higher accomplishment—to walk, or rather to crawl, about the fragments of decaying matter upon which creatures of this kind live.

The dorsal surface, although not provided with cilia, is sometimes invested with immovable hair-like processes, which perhaps may be looked upon as protective in function. The body is in most cases rather compressed and is dorsally convex, ventrally flat. The mouth and anus are usually conspicuously developed and on the ventral side. Trichocysts are rarely present.

Family Chlamydodontidae.—"Animalcules free-swimming, ovate, with a convex dorsal and flattened ventral surface; the cuticle elastic or indurate; the ventral surface more or less completely clothed with fine vibratile cilia; the oral aperture opening

on the ventral surface, followed by a tubular pharynx, the walls of which are strengthened by a cylindrical fascicle of corneous rods, or a simple corneous tube; no stylate appendages or fascicle of caudal setae at the posterior extremity."

Chilodon cucullus Müller, is roughly oval in shape, and is about twice as long as broad, the posterior

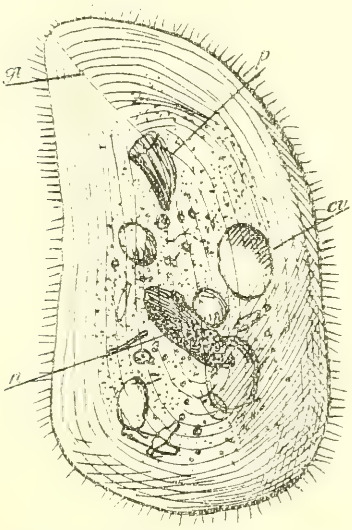


Fig. 31.—*Chilodon cucullus* (× 250).
gr, groove running to mouth; *p*, pharynx, with rod basket-work; *cv*, contractile vacuoles; *n*, nucleus.

end is rounded, and the anterior end bears on the left side a lip-shaped prominence From the end of this projection, a fine groove runs obliquely inwards towards the oral aperture. A row of adoral cilia runs along the front margin, and round over the lip. The oral aperture is on the ventral surface, and from it leads a tubular pharynx. This is strengthened by rod-shaped pieces of hardened cuticle, which form a framework to it, something like the upright rods of a hamper. They may be protruded slightly from the oral aperture. The nucleus is oval or spindle-shaped, and encloses a well-marked nucleolus; numerous contractile vacuoles are present, scattered over the ventral surface of the body. The cilia are, of course, confined to the ventral surface, and are primitive in character. The length of the body is from 100 to 300 microns.

This species occurs very commonly in both salt and fresh water. It presents a large number of different forms, and thus has attained for itself a long list of synonyms, which it is hardly worth while to write down here. It is placed by Bütschli in the order Gymnostomata, which forms a part of Stein's order, Holotricha.

Family Oxytrychidae.—"Animalcules free-swimming, ovate or elongate; usually with a flattened or concave ventral, and a more or less convex dorsal, surface; peristome field ventral, triangular or arcuate; oral ciliary system consisting of an outer or right-hand marginal fringe of powerful adoral cilia, which is frequently supplemented by oppositely reflected or left-hand marginal series of smaller preoral cilia, and more rarely by a median series of lax and alternate endoral cilia; locomotive cilia sitose, stylate or uncinate, variously distributed upon the remaining ventral surface and forming separate sets or groups, distinguishable as the frontal, ventral, anal, marginal and caudal series; supplementary immobile, hispid, or hairlike setae sometimes present on the lateral margin, or more rarely on the dorsal aspect."

Stylonichia mytilus Ehrenberg, is perhaps a convenient type of the more highly developed Hypotricha. The body is oval in shape, and rather more than twice as long as broad, the front end is rather wider than the hinder end, which is often rather abruptly truncate. The cilia are arranged as follows on the ventral surface. Five groups may be distinguished, without considering

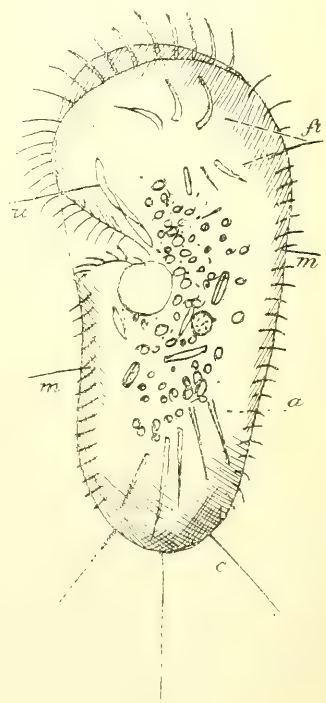


Fig. 32.—*Stylonichia mytilus* (× 250).
fr, frontal series of cilia; *a*, anal series of cilia; *c*, caudal series of cilia; *m m*, marginal series of cilia; *u*, undulating membrane. (The ventral series of cilia is not shown.)

those bearing special relation to the peristome field. The first group is called the frontal series, and occupies the right-hand front portion of the ventral side. The anterior: three or four in this

group are claw-shaped, the remaining two others bristle-shaped. The second group is called the ventral series, and occupies the centre of the ventral surface, it consists of five stout cilia, arranged like the five used in dice. The anal series, or third group, consists of five bristles, arranged in a straight line near the anus. The fourth group is termed the marginalseries, and forms an even fringe down each side. The fifth group, or caudal series, consists of three stiff hairs projecting from the posterior extremity. These groups of cilia are present, more or less developed, throughout the whole family Oxytrichidae, and this relative development forms a convenient basis of classification. The peristome groove occupies the entire left side of the anterior ventral surface. Its inner border is reflected, and bears an undulating membrane, which may easily be discerned. Two nuclei are present, and one contractile vacuole, which is situated near the posterior end of the peristome. The length of the body is 90 to 360 microns, approximately.

This species is very common; it occurs in fresh water and in flood overflows.

Gastrostyla steinii Engelman.—The body is elliptical, with each extremity rounded; it is slightly widest posteriorly. The peristome field extends backwards about one-third the whole length of the body; its inner border is reflected and bears an undulating membrane. The arrangement of the ventral cilia is as follows: the frontal series con-

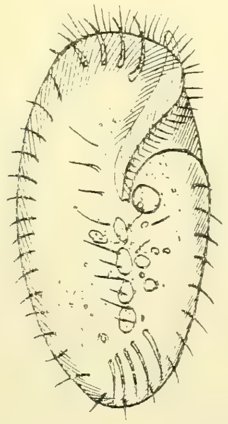


Fig. 33.—*Gastrostyla steinii* (× 250).

sists of six stout cilia, of which the three anterior ones are more highly developed than the three posterior ones. The ventral series consists of an oblique line of cilia running from the right hand border towards the anal area, and in addition three scattered styles. The anal series consists of four or five bristles forming a single oblique row which does not project beyond the posterior extremity. The marginal setae are coarse and increase in length as they approach the hinder end of the body. The contractile vacuole is situated close to to the posterior angle of the peristome. There are four oval macronuclei present arranged in a line down the centre of the body, and by each is a small micronucleus. The length of the body is from 150 to 300 microns.

This species occurs in fresh water.

Opisthotricha parallela Engelman.—The body is in the form of a long ellipse, with both ends bluntly rounded. The peristome field is fairly

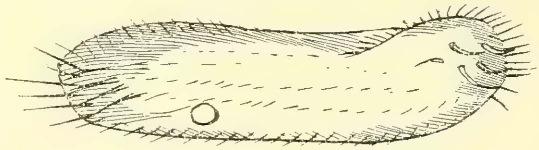


Fig. 34.—*Opisthotricha parallela* (× 250).

wide and extends back to a distance of one-fourth the entire length. The ventral cilia are arranged as follows: the frontal series consists of five claw-shaped and three bristle-like cilia; the ventral series is formed of five scattered cilia; the anal series consists of five bristles which project slightly behind the posterior border. The marginal cilia are large and form a continuous fringe. In addition to the ventral cilia the dorsal surface bears several longitudinal rows of hair-like excrescences. Two oval nuclei are present and one contractile vacuole. The length of the body is about 250 microns.

This species occurs in fresh water.

(*To be continued.*)

Late Flowering Plant.—We understand a remarkable tribute to the mildness of the autumn in the form of a branch of vegetable marrow plant, has been grown by Mr. G. H. Cockle, of 6, Dover Place, Bath. Upon it was counted, on November 5th, between twenty and thirty miniature marrows, and in one case there is a perfectly developed bloom. The whole proceeded from a fasciated stem, an abnormal form often found. Such a stem in common daisy was figured in Science-Gossip, Vol. ii. p. 43.

Albinism in Flowers.—May I be allowed to revert again to this subject, and also to that of double flowers? I should much like to know if any reason has been, or can be, assigned for albinism? Why it occurs so frequently in flowers with red or blue in their colour? Why not in yellow? Why albinism is so frequent in some species and so rare in others? Whether it is constant in the same individual? I have only once seen *Carduus crispus* and *Geranium pyreniacum* with white flowers, *Cnicus acaulis* only in one place, but many plants, while *Cnicus palustris* is as often white as purple, and about here grows chiefly on the dry tops of the hills on the downs or high tablelands, instead of marshy places. Then as regards double flowers, why should *Cardamine pratensis* produce double flowers so comparatively frequently, when in other plants they are of such very rare occurrence? If any light can be thrown on these points it would be of great interest.—*A. E. Burr, Bath; November 17th.*

INSTINCT.

By R. Dickson Bryson, B.A., F.P.S., F.R.As.S.

INSTINCT OF PLANTS.

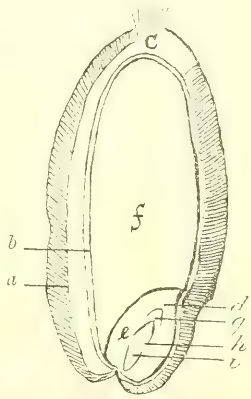
IT is proposed to offer a series of chapters on instinctive phenomena; and as the living and the instinctive are correlated, it is necessary to have some notion of what life is before we proceed to discuss its qualities. Recent science identifies it with physical force, and ascribes its complex phenomena to a state of flux and interaction between the molecules of organic structures. That, of course, is mere hypothesis, and is not very probable. It has never yet been shown that force, chemical or electric, is correlated to the living principle. Apparently the principle of life is antagonistic to chemical and electric force. Neither will animate a lifeless organism; all attempts, hitherto, to resuscitate the lifeless have failed.

Force is not life—infinity is between them. Their functions and methods are totally different. Force is concerned with the production of material, with which in its ultimate essence it may be the same thing, and life with its absorption. Force provides and life utilizes. What the two principles are in their essence we cannot say. Man would fain know, but the problem remains, and is likely to continue unsolved. Experiment, however, amply proves life to be a thing of itself.

Instinct is a property of the living, and is common to plants and animals. It is a habit impressed upon the organs, which has been predetermined by the nature and necessities of their existence. Its operations are independent of will, and are invariable, necessary and infallible. In the animal it co-exists with conscience, in the plant it does not. Though plants perform their destined functions they can have no share in the prospective issues involved in the process.

Instinct is manifested in the simplest as in the most complex forms of life. In the simple cell—that living unit—its operations are most distinct. All living structures are built up of these cells, and perhaps the sum of their operations constitute the whole of instinct.

Living structures grow, and this growth requires that new material be supplied; and it is in the means taken to supply this material that the instinctive operations are most distinctly seen. Nowhere, perhaps, is this more remarkable than in the germination of a seed. Take a grain of wheat. The accompanying figure represents it in a longitudinal section. Observe the two coverings (*a* and *b*), the outer and the inner. At the apex is the awn (*c*) and at the base (*e*) the embryo; while *f* represents the flour, or the albumen, of the seed. Examine the embryo more particularly. Observe its four divisions: the young seed-leaf, or cotyledon (*d*), the plumule, or bud, of the plant (*g*), the root, or radicle (*i*), and the stem (*h*) between the plumule and the radicle. The embryo is to all intents and purposes a young plant, and, like every other mortal, requires a start in life. This start is brought about by a conjunction of the circumstances necessary for its existence, viz., heat, air and moisture. In the presence of these elements our seed germinates, and the embryo begins to grow. The plumule is pushed upwards, and the radicle pursues a similar course downwards. The growing plant requires to be fed. The embryo thus beginning life is helpless and delicate, and would be unable to succeed in the struggle for life were provision not made. For this contingency the parent plant has very amply provided, the flour being an abundant supply for all the wants of the baby plant. There is, however, a law in vegetable economy, that plants can only absorb food in a liquid state; and flour is an insoluble solid. This difficulty is overcome by the joint action of the heat, air and moisture chemically decomposing the flour.



Section of Grain of Wheat.

The process may be thus described: starch is converted into sugar by the addition of four atoms of hydrogen and oxygen, and these elements are obtained from the moisture, H_2O, in the atmosphere. Thus: starch, C_{12}, H_{10}, O_{10}; grape sugar, C_{12}, H_{14}, O_{14}. The gluten of the wheat flour is chemically identical with albumen, animal fibrine, and casein, all containing nitrogen. Gluten differs from starch in possessing more than one-sixth of its bulk of nitrogen, an element in which starch is deficient. In the ordinary domestic process of fermentation, a ferment is introduced into the wort by which decomposition is effected. So in germination a ferment is developed which converts the starch into sugar. The gluten decomposes and becomes diastase, a ferment which decomposes

the starch. By a rearrangement of the molecules the starch is converted into gum, or dextrine, and finally into grape sugar. Such, in brief, is the method by which the embryo plant is provided with the means of subsistence. Observe that it involves (1) the presence of flour, (2) that the flour must be able to resist decomposing agencies until required by the germinating embryo, and (3) that it should be easily convertible into a fit condition for the requirements of the plant. The plant lives unconscious of the operation; it has no share in the prospective issues involved. The whole process is necessary, invariable and infallible, due to an original impression made upon its organs, called instinct.

As soon as the grain germinates, and root and stem appear, each manifests its own properties. The stem rises to the surface, and the root proceeds downwards. The one seeks from the atmosphere and the other from the soil the different elements necessary for their existence. Their constitution is even modified to suit their different functions. The anatomy of the root is widely different from that of the stem. However the seed is placed, or whatever obstacles introduced, they cannot be made to change their directions; the stem will rise and the root will descend. The experiments of Duhamel prove this. Into a glass tube containing some soil, introduce a bean—an ordinary haricot bean, and through the glass watch the development of the root and stem. Each obeys the law of its being—the growth of the stem is upward and that of the root is downward. Invert the glass, so that the root may be uppermost, they will each bend and resume their primitive directions. Replace the tube in its original position, and they will again change their directions. Each inversion of the tube is followed by a new inflexion of the root and stem; and if the room in which the experiment is made is lighted on one side only, the stem will turn towards the light and the root towards the dark. Here are all the evidences of instinct, it may almost be said of an energetic will. The cause of the invincible obstinacy of these organs to maintain their primitive directions is within and not without the plant.

A seed carried by the wind haply falls into a cave where there is a scarcity of moist earth, the air vitiated, and the light feeble; in short, all the elements necessary for germination, but of an inferior quality. In that meagre soil, amid darkness, and in the absence of fresh air, it notwithstanding germinates and produces a plant. While with a free supply of air, in a normal place and in favourable conditions, the stem would be short, thick, and coloured, in the cave, it is long, slender, and blanched. It has stretched itself, as it were, towards the aperture through which the light and air are streaming in, if possible to procure from these elements a sufficiency of food to prevent its dissolution in death. We can scarcely observe without some feelings of misgiving its silent and persistent efforts to obtain these coveted elements, light and air. We may inquire, in view of these facts, whether the plant is directed by an exquisitely delicate sense peculiar to its kind, or whether it obeys a general law, that the living seek those conditions favourable to their healthy development and perfection? In either case, the operations are instinctive.

Passing to other facts. Here is a plant supported by the thin layer of soil that covers the rock. No other situation, perhaps, could be more unfavourable to the healthy growth and vigour of its roots; yet they develop, and that in such a way as to excite our wonder. The roots insinuate themselves into the fissures of the rock, and by a series of gentle but continuous efforts, that delicate root, of which the tissue is soft and spongy, becomes an agent potent enough to split the rock. It has achieved that gigantic task by the persistent application of its tiny forces. So true is it, that to triumph over an obstacle, that which effects most is not the sudden and violent effort, but the gentle and persistent one. Still, why so much effort, and to what end such a result? For answer, follow the root in its track and the secret will be soon learned. The root goes straight through the stone to a tiny spring at its base. The huge rock is unable to oppose forces powerful enough to resist its gentle progress, and it must yield to allow of a passage to the water. Have these tiny roots a subtle scent or a delicate touch that leads them so unerringly to the water? Is the passage through the rock not fatal, and of necessity, since seeking the water they seek life?

We have not yet finished with vegetable nature, but it is clear that plants possess instinct in its two most striking forms—the preservation of the individual and the species.

In the wide range of plant phenomena few, perhaps, are more interesting than those connected with pollen and its dissemination. A complete plant, it is well known, has two essential organs destined to perpetuate the species. At the base of the pistil is the ovary containing the ovules, while at the apices of the stamens are small sacs or anthers containing the pollen. The ovules to be fecund must be fertilized with the pollen; this is essential to insure the development of the fruit and seed. Remove either the stamens or pistil and the flower will die infructuose. The essential organs are not always found on the same plant. There are imperfect as well as perfect flowers, otherwise male and female. The two sexes may be found on the same or on different plants. These latter need not necessarily be contiguous, indeed they are sometimes separated by great

distances. The common campion (*Lychnis dioica*) is an interesting case in point, and is sufficiently well known. Apropos to these monosexual plants a story is told by Jussieu, the French botanist. He had two female turpentine trees (*Pistacia terebinthus*) which annually blossomed, but bore no fruit. One year, however, the savant was surprised to discover fruit, and as there were no male plants in the neighbourhood to account for the anomaly, he enquired on every side, and was ultimately informed that a male *Pistacia* had flourished in a nursery at Luxembourg, nearly two hundred miles distant. Facts such as these are well known to every botanist.

What guides the pollen in the air, and prevents its straying when so many different routes offer—when the atmospheric currents could transport it in every direction? What guides, may be repeated, that impalpable powder in the immense ocean of air, and brings it so surely to its destined end? Pollen strays in water no more than in air. Aquatic plants in this respect are full of interest. The water crowfoot (*Ranunculus fluviatilis*) generally expands its flowers out of the water, but it not infrequently happens that the flower stalk is too short to reach the surface, and in that case the flower-head gradually swells without bursting. This improvised sac contains a gas which acts as a buoy and keeps the flower-head perpendicular to the surface, so that its pollen can neither be lost nor altered by contact with the water, and fertilization is carried on without difficulty. I was enabled to personally observe these interesting facts on the Nith, near Dumfries, some months ago.

In many of the continental rivers is found a plant, neither pretty nor sweet-smelling, but which nevertheless has been long held in admiration by botanists. This is the spiral *Valisneria*. This plant, in botanical nomenclature, is monoecious: it bears on the same plant, but on different stems, male and female flowers. The male flowers are on short, straight stems, and the female on a stalk which is a curiously-developed spiral. When the time of fertilization arrives, the male flower, enclosed in a sac and on the point of bursting, is detached from the stem and rises to the surface. The female stem at once unwinds itself and also rises to the surface. Arrived there the male flower bursts, and scatters its pollen, which is received by the pistil. This interesting performance over, the female spiral stem resumes its normal position in the bosom of the water.

Many stories have been told about the sensitive plant. Some who claim no mean eminence in our science ascribe to it an indefinable sort of sensibility. But all speculation aside, the facts are: the leaf is compound, and the leaflets are arranged symmetrically along both sides of the petiole, like the barbs of a feather. If a single bag is touched the impression is communicated to all, and in pairs they embrace the stem to its full length, each pair overlapping the other. Thus the physiognomy of the plant is entirely changed, the drooping leaflets and stem give it a withered appearance. After a few minutes it revives and the plant again appears normal. The experiment may be carried on indefinitely, and if the plant is healthy and vigorous and the temperature slightly above normal the phenomenon is more marked and rapid.

The marks of fatality peculiar to instinct are said to be very evident here, so much so that many investigators, particularly on the Continent, believe these especial plants to possess a *vegetable consciousness*, whatever that may mean. Whether or no, judgment must be suspended.

If we examine the sensitive plant, at the base of the petiole, just where the leaf is attached to the stem, a small node is found called the *motor node*, because on it depend the peculiar movements of the plant. It is the condition of this node that determines the rigidity and flaccidity of the leaf. The explanation is that one of the functions of the plant is to develop glucose, which accumulates in the nodes. There it absorbs moisture and the stem becomes rigid; but the glucose gradually decomposes, finally disappearing, and with it the accumulated water; then the leaflets become flaccid. The glucose is the cause of the movements, and this substance owes its existence to sunlight. Under the influence of sunlight it is formed, and in its absence is destroyed. During the day it accumulates gradually in the nodes, there is therefore a concentration of moisture, a determination of moisture to that part, and a progressive rigidity of the stem. This operation is gradual and continuous. Then follows a series of inverted phenomena at regular and periodical intervals. Thus that marvellous instinct, that apparent sensibility, is transformed into chemical action which determines a mechanical act.

The rotation of the common sunflower is due to a similar cause. The capitulum inclined at a constant angle follows the sun in its march. This phenomenon proceeds from a difference of energy between the two opposite surfaces of the stem. The one surface is constantly exposed to the sun, while the other is not. In the one case glucose is formed, and in the other it is decomposed From this results the movements which have gained the flower its name. As the sun proceeds in his march over the heavens, the different parts of the surface are successively exposed to his rays, and so the movement is propagated round the stem.

Phenomena such as these have, in reflective and intelligent minds, raised the question whether plants are capable of sensation, whether they are conscious of pain, whether vitality can be destroyed

without suffering. The question is not at all absurd.

Speaking broadly, there is a general sensibility in all living bodies, a sensibility, however, essentially different from that property of nervous matter to which we owe our capacity of the five senses. Every living being, or otherwise living substance, is sensible, if by sensibility we understand that modification produced in living beings by stimulants, that is, by light, heat, electricity and moisture. Living matter reacts under the influence of stimulants, and it is this that constitutes the sensibility common to plants and animals. This first phase of sensibility is the same in all living beings, from the humblest plant to man, the highest animal. It is the modification of living matter produced by stimulants. In the economy of the plant all is arrested there; but in animals there is another phase—the action produced on the brain. A cord under tension, for example, may be made to vibrate and the vibratory movements of the air are transmitted to the different parts of the ear and reach the acoustic nerve. So far there is only a movement of a certain nature and the changes produced on the nerve under the influence of that movement. An impression is made; how effected we do not know.

We now enter the domain of philosophy, on the threshold of which the physiologist, well advised, halts. The eye is struck by the luminous rays, and the optic nerve is modified: that is sensibility from the physiologist's point of view. Then sensation is produced, and the eye sees: that is sensibility in the proper acceptation of the term. It is merely a question of understanding, and not confounding, distinct phenomena under the one term. Still, even in the first phase, is sensibility identical in all living beings? Claude Bernard answers in the affirmative. There is only one kind of sensibility, since plants and animals under the influence of ether or chloroform exhibit similar effects. The animal or man inhaling ether or chloroform is soon plunged into somnolence, the limbs become flaccid, and placed in any position whatever, they remain thus, impotent to move. In that state we may experiment with the animal, or perform operations on man; neither is conscious of pain. Further, the action varies with the animal and the duration of the inhalation. It requires five minutes to anæsthetise a dog, a cat less, a hare still less, a rat least of all; and no animal is more rapidly anæsthetised than a bird, even the feeblest quantity of ether being sufficient.

Certain plants under the influence of chloroform exhibit effects analogous to those of animals. Thus, the sensitive plant refuses to exhibit its peculiar behaviour when anæsthetised. When under the influence of ether or chloroform it appears to lose its sensibility, its leaflets are pendant and quite inert, it is indifferent to the application of other stimuli, the whole plant is, as French physicians say, *resolu*.

Take an aquatic plant and place it in a bottle containing a small quantity of ether or chloroform. No change appears in the plant, and one would think it quite normal. Collect the gases and examine them, and we learn that the plant is exhaling carbonic acid (CO_2) and appropriating oxygen, while in its normal condition it fixes the carbon and rejects the oxygen. Transfer the plant to fresh water, and it will begin to live as before.

A germinating seed may be anæsthetised. Place a cress seed, the germination of which is most rapid, on a wet sponge, and a few hours after the rudimentary stem and root will appear. Cover the sponge with a bell, and under it introduce the vapours of ether. At once development is arrested. The plant is not dead, it is simply in a state of lethargy; for if the bell is removed, and a current of fresh air passed over it, it will again begin to germinate.

May we not conclude from these facts that sensibility is of the same nature in plants and animals? And because ether acts upon both, may it not follow that the effects are identical? To answer that question, it will be necessary to study the phenomena of the simple cell. It is to the cell, that living unit, we must go to observe the action of anæsthetics. Animal and vegetable cells lose their transparency under the influence of ether, and recover it soon after that excitant has been removed. Life is suspended as long as the cell is opaque, and reappears with the cell's transparency. The seat of sensibility is in the cell; and the identity of the cell, as well as the identity of their modes of action under ether, justify the inference that the sensibility is of the same nature. That, however, is merely the first phase of sensibility, and we may not infer that the plant is amenable to joy and sorrow.

All living beings, therefore, have something in common, a relationship more or less close according to the beings considered in the two kingdoms. The cause which determines the evolution of the body in plants and animals, the phenomena to which that evolution gives rise, are the same. There is not a material life proper to plants, and another proper to animals, the same life animates all.

May it not be the same with instinct? Is instinct not common to the plant and the animal, if not wholly at least in part? The movements of plants natural or provoked, are the result of physical, chemical and physiological actions. There is nothing unreasonable in the view that certain movements of the animal may be explained in the same way.

(*To be continued.*)

A NATURALIST IN SOUTH-EASTERN EUROPE.

By Malcolm Burr, F.E.S., F.Z.S.

(*Continued from page* 165.)

BROD, which means in Croatian, "ford," is a village bisected by the Save. The northern part is known as Slavish Brod and the southern as Bosna Brod, the two being united by a very fine modern bridge. It is at Bosna Brod that the traveller begins to observe Turkish influence. Most natives wear the fez, and there are many Mahomedans in turbans. Strolling along the southern or Bosnian bank of the river to pass away the twelve hours of waiting for the train, I took several species of *Stenobothrus*, a *Nemobius*, *Calopteryx*, *Labia minor* and other insects, but nothing very rare.

The narrow railway line runs almost due south through the hills of northern Bosnia, and during this journey I saw for the first time a woman in a yashmak.

It was about midday, Monday, July 18th, that the train arrived at Sarajevo, perhaps better known as Bosna Serai. Here there is a quaint mixture of oriental with occidental manners and customs. Side by side are seen men in turbans, and smart Austrian officers, and a more or less up-to-date hotel next to a white mosque.

That afternoon I called on Herr Apfelbeck, at the Landesmuseum, who very courteously gave me information about the best collecting-grounds of the neighbourhood. So on July 19th, following his advice, I walked along a good road by the side of the Miljachka [1], a stream that runs through the town, as far as Kosija Chuprija, the Bridge of Goats, which spans the river in one arch, and is said to have been built by the Turks about the year 1600 A.D. It is a very pretty road running alongside the stream, with great hills rising on each side, some dry and barren, and some thickly wooded. Half way along I saw a large grass snake, but left it undisturbed. A man with a cart behind me, however, cursed the creature and hurled great stones, but it escaped.

On the hills beside the river I took *Stenobothrus miniatus* Charp., *Caloptenus brunneri* Stal., *Oedipoda miniata* Pall., *Leptophyes albovittata* Koll., *Mantis religiosa* L. (nymph), two or three species of *Zygaena* and *Satyrus*. While hunting for *Notonecta* and *Gerris* in a little pond, I saw a curious creature crawling along the bottom, which proved to be a crayfish or "krebs," otherwise "écrevisse" (*Astacus fluviatilis*). The locality, which did not appear to be very rich in animal life, was somewhat disappointing.

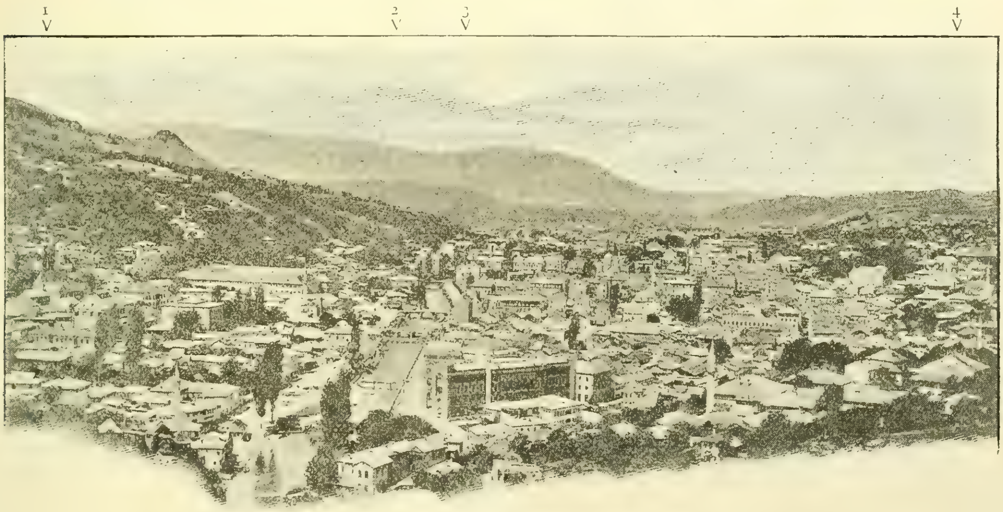
(1) Owing to the difficulty of reproducing the various diacritical signs used in the Croatian tongue, I have spelt some of the words phonetically.

The following morning, July 20th the local train took me to Ilidzhe, a pleasure resort, thirteen kilometres from Sarajevo. The Austrians think it charming, with its merry-go-rounds, booths, shooting galleries, and nicely laid-out gardens; but not having come so far as Bosnia to go to a fair, I walked on about two miles further, to the source of the Bosna, There the river suddenly appears at the foot of a mountain in several separate springs, which unite almost at once. Thirty yards down from its source the stream is as many yards broad. Over that mountain I was told was the pass of the Igmán Planina, so I straightway set to work to clamber up a very steep path on the side of the thickly wooded hill. Here were *Stenobothrus morio* Fabr., *S. biguttulus* L., *Gomphocerus rufus* L., *Pachytrachelus gracilis* Br., and higher up *Aphlebia maculata* Schreb., with *Ectobia lapponica* L., and *Thamnotrizon transsylvanicus* Fisch. Near the top the path was at one moment a wide bare strip in the wood, at another a narrow passage cut through overhanging rocks. At one place I gave a casual sweep of the net among some high weeds, and found, to my great delight, that it had captured a pair of one of the larger species of *Poecilimon*. They are magnificent emerald-green grasshoppers, very large, with rudimentary organs of flight, and long slender antennae. I heard *Gryllus campestris* L. chirping, and marked him down as he was sitting under a plank. A quick grab, and he was caught. I was greatly pleased with my dexterity, but his want of activity, I found, was to be accounted for by an absence of hind legs, perhaps lost in fight. Among butterflies I noticed *Papilio machaon* and *P. podalirius*, *Polyommatus thersamon*, *Lycaena corydon*, *Limenitis camilla*, *Erebia*, sp., and one hawk moth, which I think was *Deilephila euphorbiae*; but it was not taken. There were also many dragon-flies: I took *Sympetrum flaveolum* and *Agrion puella*, and here I got a specimen of the beetle, *Cicindela hybrida*.

Once the summit was reached, the scenery was very fine. Behind me lay spread out a fertile valley, with Ilidzhe at my feet, and Sarajevo nestling at the foot of Trebovic, a solitary hill in the distance. In front rolled valleys and thickly wooded mountains as far as the eye could reach. The average height of this Planina was 4,000 feet. At the foot of the pass I took *Leptophyes albovittata*, *Poecilimon*, and *Xiphidium fuscum* Fabr.; and among dragon-flies, *Orthetrum brunneum* Fonsc. and *O. ramburii* Lelys.; but on a second visit to the same spot a little later, I found nothing further.

After that, in company with a German assistant from the Landesmuseum, an excursion was made to Lukavica. This is a fertile valley south-west of Sarajevo, giving a good view of Trebovic, the Igmán Planina, and the hills behind the capital. Here we took nothing very striking; the only additional species being *Platycleis roeselii* Hagenb. A few days afterwards Mrs. Nicholl and Mr. E. Witty joined me. They had already done a considerable amount of collecting in the neighbourhood, and in Dalmatia, Herzegovina and Montenegro. Together we ascended Trebovic, which is very rich in animal and vegetable life. On the very top, I took a single specimen of *Gomphocerus maculatus* Thunb. Strange to say, no other example of the species was seen by me the whole time I was away. It seemed most unlikely to take among the stones at the summit of Trebovic a little grasshopper which in England is nearly always found on sandy heaths. Here also occurred a female of the beetle *Anisoptia caerula*. On the actual top of the peak is a round polished stone, like a table, marking the highest part. Standing on this stone, the traveller sees a lovely panorama. The hill is isolated, standing quite alone in the centre of the valley, affording a fine view of the mountains all round. Every now and then we saw a stone falcon (*Falco lithofalco*), with wings outspread, hanging over the valley at our feet. I am not positive as to the identity of the bird, but the natives called it "steinadler," and as far as I could tell, without seeing one close enough for examination, they very closely resembled a preserved stone falcon that I have at home.

The peak of Trebovic, which reaches an altitude of 1,680 mètres, is dry and stony, without much vegetation, but a little lower down the hillsides swarm with insect life. The most notable species of all, perhaps, was *Stenobothrus miniatus* Charp, with its peculiar buzz when settled and harsh clattering noise when on the wing. This, with its black wings, make it a conspicuous object and very easy to catch. Under every stone was a small colony of *Ectobia lapponica* L. Besides *Stenobothrus nigromaculatus* Herr. Sch., *S. dorsatus* Zett., *S. parallelus* Zett., *S. bicolor* Charp, hopping about in numbers in the grass were numerous *Decticus verrucivorus* L., here and there a great active *Thamnotrizon transsylvanicus* Fisch, a dark, fighting, carnivorous insect that can give a good nip with its powerful mandibles. A less pugnacious and handsomer creature was there too, *Thamnotrizon frivaldskyi* Herm, much less stoutly built and of a delicate green colour. Species of flightless Phaneropteridae, including *Isopbya obtusa* Boi., kept turning up in the net after a sweep, delicate insects that lose their colour at once and are very difficult to determine. Under a stone I discovered a single immature female *Anechura bipunctata* Fabr. This alpine earwig was the only Forficulid that I took, excepting, of course, the two common species, *Forficula auricularia* and *Labia minor* L. Among Lepidoptera I noticed, as an outsider in their study, *Parnassius apollo*, the first time that I had seen this magnificent insect alive. Mr. Witty took some, and told me that they were some variety based on the absence or presence of certain spots, but unfortunately I have lost the note, and so the name. There were numbers of *Erebia* flying about, appar-



View of Sarajevo.

1, Trebovic. 2, Igmán Planina. 3, Ilidzhe. 4, Dolac.

ently two species. There was one variety, *Erebia tyndarus*, var. *bosniensis*, otherwise var. *balcanica*, a variety close to *ottomanus*, in which the underside of the hind wing is dusted over with a beautiful powdery blue, giving the insect, when flying, an appearance most unlike an *Erebia*. There was also a large *Coenonympha*, *Colias* and some *Lycaenidae*. I found a nest of *Polistes* attached to a blade of grass, a small conical wasps' nest, of a little more than a dozen cells, attached by the base to the grass. The cells were all empty. In trying to bring it home, the nest dropped off, and later I found myself, unfortunately, carrying an ordinary piece of grass without the nest.

One other excursion in the neighbourhood of Sarajevo was to a suburb named Dolac, for which one has to alight at a station on the Sarajevo-Ilidzhe railway, rejoicing in the name of Alipashin Most (2). Dolac is a row of low hills, just outside the town, covered with grass and a few low shrubs. It was an extremely disappointing day, as, excepting the common *Oedipoda caerulescens* L., I captured nothing that could not have been taken any day in the summer near home.

Sarajevo is a curious mixture of modern and old-fashioned buildings, the latter, of course, being the poorer quarter. The railway station is quite two miles from the town itself, with which it is connected by a fast electric tramway. The new part consists chiefly of Government buildings, hotels and banks, erected since the Austrians have held the country in military occupation. One of the most interesting buildings, after the Landesmuseum, is the Handelsmuseum, where the stranger buys examples of the forms of local art. The most characteristic is, perhaps, inlaid work of every description. Turkish carpets and hammered metal, often very handsome, are also on sale. The most oriental quarter of the town is the bazaar where the various little shops are classified: all the iron workers together, all the fruit shops together, and so on with other trades. In these little booths one often sees a venerable Turk sitting, tailor-like, with legs tucked under, smoking a chibouque and sipping coffee all the afternoon, whilst talking the latest scandal with his friends.

In the Landesmuseum I only saw the insects, and, judging from what Herr Apfelbeck showed me, Bosnia seems to possess a very large share of peculiar species of Coleoptera. In the museum they have also an ethnological collection of life-sized figures to illustrate the costumes of the district.

The town is divided among four religions. Nearly half are Mahommedans, while there are many of the Greek, or Orthodox, Church. The remainder are Roman Catholics and Jews. The so-called Turks in Bosnia are, of course, rarely Turks in blood. They are called "Turks" in the sense Mahommedan. The Bosniaques are Slavs allied to the Serbians. Their language is Croatian, which is merely a dialect of Serbian (3), using the Latin alphabet instead of the Cyrillic. A Mahommedan Slav praying to Allah, yet speaking a tongue allied to Russian, seems an anomaly. Notices to "beware of the train," and such like, are always in four languages, German, Croatian, Serbian, in Cyrillic characters, and Turkish. In fact it is a most polyglot place. Strange to say, there is a strong Spanish element in Sarajevo, that tongue being spoken in many of the shops.

On one occasion we went into a mosque and saw the Faithful at prayer. We, being Giaours, or Infidels, were permitted to go up into a gallery, to watch in silence. The service was long and dreary, consisting chiefly of dull chants from the Quran, and repetitions. It was enlivened by a dancing Dervish, a tall individual in a long white cloak, worn tight as far as the waist and then loose. His head-dress was a very long white fez. On two occasions he twisted and twirled round in the middle of the mosque for a period of about ten minutes, stopping suddenly, as the chant ceased, without appearing in the least giddy. After the second dance he went out. I was told that for that performance he received six florins, just half-a-sovereign, and if he went into a café the proprietor was only too delighted to serve, gratis, such a holy man. We came out of the mosque with the monotonous chants still ringing in our ears, "La illah, il Allah, Mahommed raz ul Allah!"

(To be continued.)

(2) This probably means "The Bridge of Ali Pasha."

MANCHESTER MUSEUM HANDBOOKS.—We have received from Mr. William E. Hoyle, M.A., F.R.S.E., Keeper of the Manchester Museum at Owens College, a series of the useful handbooks issued at that institution. They consist of (1) "Catalogue of the Books and Pamphlets in the Library"; (2) "Descriptive Catalogue of Embryological Models"; (3) "Handy Guide to the Museum"; (4) "Outline Classification of the Vegetable Kingdom," by F. E. Weiss; (5) "Outline Classification of the Animal Kingdom," by the late Professor A. Milnes Marshall; (6) "Nomenclature of the Seams of the Lancashire Lower Coal Measures," by Herbert Bolton, F.R.S.E., and four pamphlets of Notes from the Manchester Musuem, being "Suggestions for a Proposed Natural History Museum in Manchester," by the late Right Hon. T. H. Huxley, LL.D., F.R.S.; "Notes on *Rachiopteris cylindrica*" Will., by Thomas Hick, B.A., B.Sc., A.L.S.; "Notes on the Ampullae in some specimens of Millepora in the Manchester Museum," by Sydney J. Hickson, M.A., D.Sc., F.R.S., "Descriptions of New Species of Brachiopoda and Mollusca from the Millstone Grit and Lower Coal Measures of Lancashire," by Herbert Bolton, F.R.S.E. These handbooks form a series of literature useful to students frequenting the Museum, and even to others who have not that opportunity. They vary in price from 1*d*. to 1*s*., the catalogue of books being 2*s*. 6*d*.

(3) Miklosich, the great Slavonic grammarian, goes so far as to consider them separate languages.

PREPARATION OF DIATOMACEOUS MATERIALS.

By Edward H. Robertson.

(*Concluded from page* 174.)

Recent Materials.

WHEN recent and not fossil materials are to be treated, some little deviations are usually observed. As a rule no disintegration is requisite. In every instance they must, however, be treated with hydrochloric acid to remove all traces of calcareous matter. When effervescence has entirely ceased the residue must be well washed. Some persons then submit them to the action of nitric acid only, until finally prepared. In some cases this simple treatment may suffice, but I have found it both expensive and not a whit more effective, and certainly a much more tedious process. Occasionally I adopt this method, and then, first of all, after application of the hydrochloric acid, place the material in a wide-mouthed bottle, pour over it enough nitric acid to cover it, cork and set aside. At the end of, say, three or four days the contents of the bottle will have been resolved into a thick pasty mass, which can at once, if desired, be boiled in a beaker or the Wedgwood vessel. The boiling-point of nitric acid being lower than that of water, great care must be observed not to expose to too great a degree of heat, lest the contents overflow the vessel. I obviate this in the following manner: I have fitted into an ordinary tin saucepan a piece of cork, in the centre of which is a circular hole, into which a beaker may be dropped. About two-thirds filled with water, the saucepan is set on a fire, or oil stove, and the beaker and contents being inserted, it may safely boil until, to make up for evaporation, fresh water or acid has to be added. After two or three hours have elapsed the material must be washed and the process repeated.

The great drawback to the use of nitric acid is that no sooner does it become even moderately hot than a series of detonations set in, these often being so violent as to cause the containing-vessel to jump bodily, quite a large quantity of the material being sometimes erupted. Nay, occasionally, when not carefully tended, I have known the whole contents of a beaker to be, little by little, blown out. This exceedingly annoying experience is entirely obviated when the water-bath is used, as described. The cause of these detonations is that the solid contents of the vessel in use gravitate to the bottom, particularly if much sand or other mineral substance be present. The layer thus formed interposes a moist stratum, and the steam generated beneath or therein finds violent vent into or through the liquid above.

Bichromate of Potash Method.

Many of the most successful preparers of diatomaceous materials employ this method. It is simple enough, and efficient where much organic matter is present in the earth to be operated upon. After treatment with hydrochloric acid, being well washed and allowed to subside, all water should be carefully poured off, and, in its place, about three times the bulk of material should be added of sulphuric acid. Bichromate of potash in powder should now be thrown in, and gently stirred with a glass rod. Sometimes considerable ebullition ensues, and the contents are liable to overflow the vessel unless care be exercised. Usually, however, the action is feeble, and bichromate in small quantities may be added until it ceases, when the vessel and its contents may be submitted to heat, more vigorous ebullition then taking place. Whatever the colour of the material when first treated, it quickly assumes an olive-green hue. When all action appears to have ceased the preparation should be poured into a vessel containing a large quantity of pure rain-water, gently stirred and allowed to settle. After well washing very little sediment remains, beyond diatoms, sponge spicules and sand. That is to say, in theory, this should be so; but, as a matter of fact, I almost invariably find that the process has to be repeated, sometimes more than once. Experience alone will enable the amateur to decide upon the method he elects to practise. I must frankly say that I prefer the chlorate to the bichromate treatment; and should the reader do the same he will find that, with occasional modifications, he may proceed very much as in the case of fossil earths, already described. Let him, however, bear in mind that by the use of the bichromate he escapes explosions and decrepitation, which are somewhat alarming to a nervous person.

Use of Liquor Potassa.

As this chemical is often very injudiciously employed in the preparation of diatomaceous materials it will be better to devote a section to the subject. Let me at once say that it should be used as seldom as possible. When, however, all the means already indicated fail to reduce the material to be disintegrated to an almost impalpable powder, the supernatant liquid should be poured off and enough liquor potassa to cover the solid matter added, and brought to a boil. The boiling should not be continued for more than one or two minutes,

or the action of this chemical upon the silicious organisms will result not only in the obliteration of their beautiful markings, but very rapidly in their total destruction. The best plan is to pour off into a vessel of cold rain-water the finest sediment which appears so soon as the liquor potassa boils, add a fresh portion to the contents of the vessel, bring this to a boil as before, and repeat until the whole has been disintegrated. If ordinary care be used no injury to the diatoms results from this treatment.

Preparation of Clays.

Hitherto I have said nothing about the most refractory diatomaceous materials, such as muds and clays, obtained by dredging, or brought up by anchors, or by the sounding-lead. These it is sometimes almost impossible to prepare with any reasonable prospect of success. Some from volcanic regions consist mainly of triturated pumice, and after the most careful preparation the few diatoms present are so thoroughly obscured by this substance, which contains from fifty to eighty per cent. of silica, that the operator must either sacrifice the whole, or devote himself with infinite patience to their separation. Then, again, as to the clays. Some of these resist the most insinuating persuasions of the ablest preparers. Popularly, any earth that can be kneaded in the hand like paste is called clay. Strictly speaking, the term means an earth that consists of a mixture of silex or flint, with alumina, usually about three-fourths of the former to one-fourth of the latter. Clays vary greatly in composition, according to the nature of the rocks from whence they have been derived, for they are simply muds formed by the erosion of such rocks. In general they consist of silica and alumina; the latter, combined with oxide of iron, gives out an earthy odour when breathed upon, and when dry sticks to the lips if applied to them. The composition of these clays will at once indicate to the diatomist the difficulty of reducing them so far as to enable him to make satisfactory preparations. Where, as commonly happens, calcareous matter is also present, this may be dissolved out by hydrochloric acid; the coarse sand, if any be present, may be eliminated. The fine silica and alumina, being insoluble in acids, cannot be disposed of, except by means that will at the same time destroy the diatoms. The amateur, therefore, should never attempt their preparation until he has acquired considerable skill in the manipulation of more tractable materials.

General Observations.

Although I have already referred to the detonations that occur when materials are being boiled in nitric or hydrochloric acids, let me here reiterate my warning not to expose vessels containing these chemicals to the direct heat of a flame or very hot surface of iron, but to use in preference a water-bath. To reduce the risk of accidents when using nitric acid, it is better, where practicable, to eliminate the coarse sand before boiling. These detonations hardly ever occur with sulphuric acid, but the fumes of this and other acids are most noxious, and the operator should carefully avoid their inhalation. If not convenient to prepare the material by their aid in a place where the fumes may be at once carried up a chimney, then let him operate in some well-ventilated out-building or in the open air.

As it is not always easy to purchase a large quantity of pure distilled water—and "hard" water should on no account be used—I always collect, when it is heavily raining, in an open situation, as much of the rain as possible, transfer to perfectly clean, clear glass bottles, add a few drops of Condy's fluid, well cork, and set aside in a dark closet until required for use. However clear when collected, a deposit will almost invariably be found at bottom of bottle, after the lapse of a few weeks, sometimes days only. This must not, of course, be disturbed when pouring out the water. I have on hand seldom fewer than from fifteen to twenty quart bottles of this pure rain-water. To be illiberal in its use means to give oneself much more trouble in the long run.

In using glass rods for stirring the contents of vessels, I prefer those tapering to a point, as the large surface of a blunt rod must inevitably injure some of the finest forms.

When glass beakers are used to boil materials in acids, and the boiling is vigorous, particles of the scalding contents are commonly deposited on the dry sides of the vessel, with the frequent result of a crack; hence it is better not to use glass at all, but Wedgwood ware. My pet pipkin has been in use for forty years, during which period my stock of glass beakers has been often renewed.

From the foregoing remarks it will be seen that there is no mystery in the art of preparing diatomaceous materials, but the manipulator should ever bear in mind that, whatever he does, he should do thoroughly. There must be no half measures in the preparation of micro-materials.

In operating with ordinary substances, raw or wrought, blemishes and defects may perhaps be disguised so as to pass muster. It is never so with the minute objects revealed to us by the piercing artificial eye of a microscope. In them the smallest blemish will readily be detected. It therefore behoves the preparer of diatomaceous materials to do his utmost to produce the very best that can be produced, and if, upon examination, the operation appears to have been imperfectly performed, then it must be repeated.

Woodville, Greenhouse Lane, Painswick, Glos.

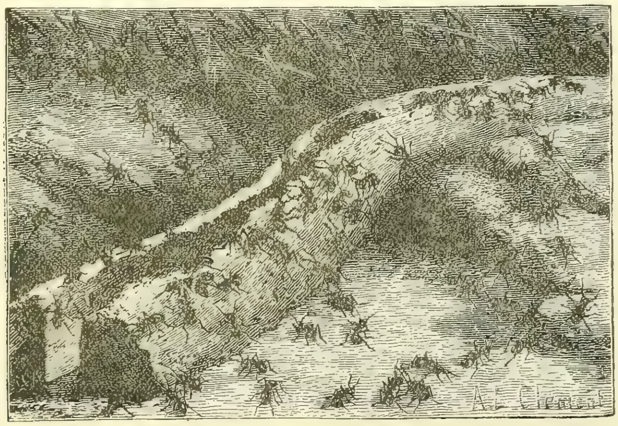
BOOKS TO READ

NOTICES BY JOHN T. CARRINGTON.

NOTE.—*In consequence of the great variety in sizes of books now published, the old descriptions, founded on the folding of the paper on which they are printed, will not in future be followed in these pages. In its stead their size, including binding, will be given in inches, the greater being the length and the lesser the breadth, unless otherwise specified.—Ed.* SCIENCE-GOSSIP.

Marvels of Ant Life. By W. F. KIRBY, F.L.S., F.E.S. 174 pp. $7\frac{1}{2}$ in. × 5 in. with 34 illustrations. (London: Partridge & Co., 1898). 1s. 6d.

Mr. W. F. Kirby, the well-known entomologist and assistant in the Insect Department of the Natural History Museum, South Kensington, has produced in this one of the best popular books we have seen for some time. By popular we do not mean the mere gathering together of a number of improbable anecdotes; for it is a really scientific work on ants, written brightly, and with an absence of confusing technicalities. In dealing with these insects the author has to steer clear of his predecessors who have made books on this section of the Aculeate Hymenoptera. The subject of ants and their habits is so attractive that everyone with an itch for writing "popular" works on insects usually turns first to ants, often knowing as little about the entomology of their subject as they do about the scientific breeding of shorthorns. Therefore, though the ants are more or less threadbare in literature, Mr. Kirby's veteran knowledge of insects renders him eminently fitted to produce a work at once popular and yet accurate in its details. In this the author has succeeded, and presented to us a charming little book which should be obtained by all interested in the wild things of the world and the marvellous instinct developed in them. It is particularly a book for young people, though it may be read by older ones also, and should be largely used as a prize book in schools. Mr. Kirby has not confined himself to the British species, and therefore has more scope to raise the interest of the reader. A wise feature of this work is chapter xvi., which is devoted to a list of trustworthy books on ants. These are divided into sections dealing with various geographical regions. The author thus first creates an interest and then gently leads his readers on to make that interest more than passing, for he indicates its scientific direction in the future.



ANTS BUILDING A COVERED-WAY.
From "Marvels of Ant Life."

The Groundwork of Science: A Study of Epistemology. By ST. GEORGE MIVART, M.D., Ph.D., F.R.S. xx. and 331 pp. $8\frac{1}{2}$ in. × 6 in. (London: John Murray; New York: G. J. Putman's Sons. 1898.) 6s.

This book is one of the Progressive Science Series now publishing by Mr. John Murray and edited by Mr. F. E. Beddard, M.A., F.R.S. Dr. St. George Mivart approached his subject in the only possible manner when writing the book before us. As he points out, many persons well able to judge would naturally object to there being a groundwork common to all sciences with their diversity of knowledge. One, at first thought, could hardly imagine a common basis for the sciences "from logic to geology." The author reminds us that "however numerous and diverse the sciences may be, they all agree in having been developed by one kind of energy, namely, that of the human mind," hence "it is evident that the groundwork of science must be sought in the human mind and in the mind of each individual man who applies himself to its study." Dr. Mivart thus gets his sub-title for the work, "A Study of Epistemology," derived from two Greek words representing a discourse on understanding. The ten chapters in this book will be found to form such a discourse of great excellence. The titles of the chapters are: i. Introductory, ii. Catalogue of Sciences, iii. The Objects of Science, iv. The Methods of Science, v. and vi. The Physical Antecedents of Science, vii. Language and Science, viii. Intellectual Antecedents of Science, ix. Cause of Scientific Knowledge, x. The Nature of the Groundwork of Science. In these chapters the author critically examines the manner by which the knowledge of the facts and truths composing the evidence supporting the present groundwork of science have been attained. Further, he inquires if the facts carry with them their own evidence, or whether

the science has been built up from speculative knowledge by idealists. He gives examples of the differences between truisms and idealisms, and discusses where or how these very different points of human knowledge and thought may be associated in constructing the groundwork of science. The necessity for careful examination of evidence, its frequent and accurate testing before acceptance as truth, is emphasised, also the danger of drifting into idealisms when building up a theory. Taking as the basis that it is only human knowledge and intelligence that construct a science, Dr. Mivart discusses how these faculties may be applied. He is evidently not satisfied with all the teachings of those who have propounded more or less accepted theories, and the objects of this book is chiefly to act as a brake on the too rapid course, without further investigation, of their general acknowledgment. This applies not only to the more modern theories, but also to some of the oldest conceptions, as may be gathered from his concluding words: "We feel bound to confess that the more we study nature the more profoundly convinced do we become that the action of an all-pervading but unimaginable intelligence alone affords us any satisfactory conception of the universe as a whole or of any single portion of the cosmos which may be selected for exclusive study." Like all Dr. Mivart's works, this should be read by every intelligent person, as many of its axioms can be applied to the means of sustaining human life under modern civilization, which, after all, is a highly interesting science in itself. Though possibly some may not always agree with the author, it is a book to be perused carefully, slowly and thoughtfully. Not on a single page do we find it heavy, or otherwise than entertaining. In places it is brilliantly written, teeming with instance and anecdote.

The Motograph Moving Picture Book. Illustrated by F. J. VERNAY, YORICK, etc. $11\frac{3}{4}$ in. × $9\frac{1}{4}$in.; 22 coloured pictures. (London: Bliss, Sands & Co., 1898.) 3s. 6d.

This is a children's Christmas book, founded upon scientific principles. It consists of a number of brightly coloured pictures arranged in straight and curved lines. With the book is supplied a frame the same size as the pictures, containing a transparent film on which is drawn numerous fine parallel lines. By placing this transparency over the picture as directed, and moving slowly in the manner indicated, the appearance of movement is given to the picture. The effect in some instances is striking. The book will be found to be a source of amusement to many young folks.

Flax Culture for Seed and Fibre. By CHARLES RICHARDS DODGE. 8 pp. 9 in. × $5\frac{3}{4}$ in. with 4 plates and 5 figures. (Washington: Government Printing Office, 1898.)

This fine Report, No. 10 of the "Fibre Investigations Series," refers to flax culture in Europe and America. The work is rather of an agricultural than botanical character, but will be of interest and use to those botanists who study the structural and other changes of plants under artificial culture.

Skertchley's Elements of Geology. Revised by JAMES MONCKMAN, D.Sc. 9th edition, 256 pp. 7 in. × 5 in. and 90 illustrations. (London: Thomas Murby, 1898.) 1s. 6d.

Another edition, the ninth, of Skertchley's Text-Book has been issued, with a large amount of new matter added, the chapters on petrology being concise and useful. In fact to a painstaking student its conciseness is the book's greatest attraction. Still, the style is not one which will attract any who have not already a taste for the subject. The editor informs his readers that he has altered little in the body of the work, but has added such matter as was necessary to bring it in accordance with the Science and Art Department's syllabus. The illustrations to the crystallographical portions of the book are good and practical, as well as the classification and description of the various rock-forming minerals. The added matter in this edition amounts to nearly a hundred pages, and, as we have indicated, is much the best part of the publication. It would have been better had the editor taken greater liberty with the rest than he appears to have felt himself entitled. In regard to chapter xv., page 99, we would suggest that the Echinodermata should be promoted to the rank of a sub-kingdom, although for geological purposes the zoological tables will possibly suffice. In dealing with the tertiaries, we notice that the title of "Oligocene" has no place, nor is it to be found in the index. The Headon Beds, the Osborne and St. Helen's Series, the Bembridge Beds, the Hempstead (Hamstead) Beds, now universally classed as Oligocene, are here divided between Upper and Middle Eocene. The classification of these Isle of Wight beds into a separate system is now universally adopted, intervening between the Eocene and Miocene. Again, why are the Bovey Tracey beds still classified as Miocene? Does Dr. Monckman yet contend that this is the proper arrangement? Perhaps mention should have been made of the Pliocene sands at Lenham, in Kent, as also the St. Erth crag in Cornwall, of the same age. Students are here taught to see in boulder-clay evidence of an ice-sheet; and no mention is made of any other school of thought. It seems to us, that although an author is entitled to write as he sees, yet other interpretations of certain phenomena should at least be touched upon, so that young students may be able to distinguish between what is fact and what is theory. We would also ask whether the foot-note to page 169 is by the author or the editor. In conclusion, we will express a hope that Dr. Monckman will some day send us a text-book which shall have been written wholly by himself, as the time seems to have passed for the reissue of works that were written before the modern light of scientific research had illuminated many points then more or less obscure. E. A. M.

First Lessons in Modern Geology. By A. H. GREEN, M.A., F.R.S. 220 pp. $7\frac{1}{2}$ in. × $5\frac{1}{2}$ in. Edited by J. F. BLAKE, M.A., with 42 illustrations. (Oxford, London, Edinburgh and New York: Clarendon Press, 1898.) 3s. 6d.

This work, as the editor reminds us, is essentially a primer in geology. At the request of Mrs. Green, Prof. J. F. Blake, after the decease of the author, undertook the editing. The book consists of eighteen easy and accurate "Lessons," the last, which deals with fossils, being added by the editor. Out of 208 pages only nine are devoted to fossils. We imagine that a second part of the work, of equal proportions, was intended to be devoted to palaeontology. The title conveys at once a correct impression of the scope and style of treatment. It is an excellent and easily-understood guide to physical geology. E. A. M.

CONDUCTED BY FRANK C. DENNETT.

1898. Dec.		Rises. h.m.	Sets. h.m.	Position at Noon. R.A. h.m.	Dec.
Sun	8	7.56 a.m.	3.49 p.m.	17.1	22° 46′ S.
	18	8.4	3.50	17.45	23° 25′
	28	8.7	3.56	18.30	23° 17′

	Dec.	Rises. h.m.	Souths. h.m.	Sets. h.m.	Age at Noon. d. h. m.
Moon	8	1.40 a.m.	7.13 a.m.	0.33 p.m.	24 11 39
	18	11.4	4.44 p.m.	10.40	5 0 17
	28	4.35 p.m.	0.2 a.m.	8.25 a.m.	15 0 17

	Dec.	Souths. h.m.	Semi Diameter.	Position at Noon. R.A. h.m.	Dec.
Mercury	8	1.20 p.m.	3″ 7	18.29	24° 52′ S.
	18	0.31	4″ 8	18.20	22° 15′
	28	11.2 a.m.	4″ 6	17.29	20° 8′
Venus	8	11.7 a.m.	31″ 0	16.16	20° 32′ S.
	18	10.15	27″ 7	16.3	17° 48′
	28	9.38	23″ 7	16.6	16° 39′
Mars	8	3.40 a.m.	5″ 9	8.48	20° 54′ N.
	18	2.59	6″ 4	8.46	21° 28′
	28	2.13	6″ 8	8.39	22° 22′
Jupiter	18	8.20 a.m.	15″ 2	14.8	11° 44′ S.
Saturn	18	11.12 a.m.	7″ 0	17.0	21° 21′ S.
Uranus	18	10.25 a.m.	1″ 7	16.13	21° 4′ S.
Neptune	18	11.41 p.m.	1″ 3	5.31	21° 56′ N.

MOON'S PHASES.

		h.m.			h.m.
3rd Qr.	Dec. 6	10.6 a.m.	New	Dec. 13	11.43 a.m.
1st Qr.	,, 20	3.22 ,,	Full	,, 27	11.39 p.m.

In apogee December 2nd, at 8 a.m., distant 252,100 miles; in perigee on 14th, at 1 p.m, distant 223,000 miles; and in apogee again on 29th, at 6 p.m., distant 252,500 miles.

OCCULTATIONS OF STARS BY THE MOON:

Dec.	Star.	Magnitude.	Disappears. h.m.	Angle from Vertex.	Reappears. h.m.	Angle from Vertex.
7	e Leonis	5	0.54 a.m.	215°	1.24 a.m.	273°
19	κ Piscium	5	3.0 p.m.	37°	3.46 p.m.	305°
29	ζ Cancri	5	10.1 p.m.	130°	11.16 p.m.	334°

CONJUNCTIONS OF PLANETS WITH THE MOON.

Dec. 3	Mars*†	1 p.m.	planet	5° 36′ N.
10	Jupiter	6 a.m.	,,	6° 15′ N.
12	Venus*	9 a.m.	,,	4° 41′ N.
13	Saturn†	3 a.m.	,,	3° 27′ N.
14	Mercury*	1 p.m.	,,	0° 3′ S.
30	Mars*†	3 p.m.	,,	6° 38′ N.

* Daylight. † Below English horizon.

ECLIPSES OF SUN AND MOON.

A partial eclipse of the sun, of very small magnitude, occurs on December 13th. Invisible at Greenwich, and only visible in low southern latitudes.

The total eclipse of the moon on December 27th–28th should be well observed. Its phenomena are as follows:

First contact with penumbra	27th	8.35 p.m.
,, ,, shadow	,,	9.48 ,,
Beginning of total phase	,,	10.57 ,,
Middle of eclipse	,,	11.42 ,,
End of total phase	28th	0.27 a.m.
Last contact with shadow	,,	1.36 ,,
,, ,, penumbra	,,	2.49 ,,

The first contact with the shadow occurs 112° east from the north point, and the last contact 95° to the west. The magnitude of the eclipse is 1·383. The edge of the advancing shadow should be carefully watched, as it frequently exhibits a bluish colour, whilst the shadow itself is often coppery. The edge, too, sometimes appears more dense than the central portions.

THE SUN still shows considerable disturbance on its surface. A group of spots visible during the early part of November had a length of at least 87,000 miles, whilst other groups were scattered about the disc. Winter is said to commence when the sun enters the sign Capricornus, at 7 p.m. on the 21st; it is nearest the earth at 10 p.m. on 31st.

MERCURY is an evening star at the beginning of the month, reaching its greatest elongation (21° 3′) east at 1 a.m. on the 4th, then closing to the sun. It reaches inferior conjunction at 10 p.m. on the 21st. Both Mercury and Venus are too far south for very successful observation.

VENUS is in inferior conjunction at 5 p.m. on the 1st, afterwards becoming a morning star, rising all the last half of the month from two to more than three hours before sunrise. At 11 p.m. on the 10th Venus is in conjunction with, and 1° 14′ north of, Uranus.

MARS is getting into good position for observation. At the beginning of the month it rises about 8 p.m., whilst at the end it rises about 5.41. It is situated in Cancer, between the 4th-magnitude stars γ and δ.

JUPITER is a morning star, rising about 4.8 a.m. at the beginning of the month and 2.37 at end, situated in Virginus, close to the borders of Libra.

SATURN is in conjunction with the sun at 7 p.m. on the 6th, and so not in position for observation; neither is URANUS.

NEPTUNE, however, is at its best, being in opposition on the 15th, at 7 a.m., and above the horizon all the hours when observation is possible, situated only a little following the "crab" nebula.

METEORS may be specially looked for about December 8th, 9th, 11th, 12th and 21st. During the first half of the month they mostly radiate from two centres in the constellation Gemini.

ENCKE'S COMET has only been visible in the southern hemisphere. Mr. Tebbutt, of Windsor, New South Wales, found it on and after June 25th, a most difficult object to observe. It was not seen after July 10th, when in a clear sky, without moon, it was but a faint whiteness, just glimpsed, 5′ or 6′ in diameter, whose exact place could only be roughly determined. Perihelion was passed on May 24th; it was nearest the earth on July 7th.

BROOK'S COMET was discovered at Geneva, New York, on October 20th, in the constellation Draco, moving rapidly to the south-east. Professor Hussey, of Lick Observatory, calculates the date of the perihelion passage as November 23rd, at a distance from the sun of 0·76 (earth's mean distance = 1·0). It is round, 7′ or 8′ in diameter, having a bright stellar nucleus, about equal to 8½-magnitude. It is moving in an orbit very similar to that of Schæberle, 1881, IV., which was visible to the naked eye for more than a fortnight in August, and had on the 21st of that month a tail 10° long. The telescope followed it for fourteen weeks.

HUNGARIA is the name given to one of the minor planets, whose discovery by Herr Wolf was mentioned on page 183, in commemoration of the meeting of the Astronomische Gesellschaft at Budapest in September.

THE NOVEMBER LEONIDS.—Bad weather seems to have prevented observations in Britain. The Americans had better fortune.

SCIENCE GOSSIP

THE Colony of Victoria has created a National Park for the preservation of its native fauna, by reserving Wilson's Promontory for the purpose.

THE Presidential Address delivered by Mr. John M. Coulter before the Botanical Society of America forms interesting reading. It is devoted to "The Origin of Gymnosperms and the Seed Habit."

A POPULAR botanical magazine, entitled "The Asa Gray Bulletin," is being issued fortnightly by the editor, Gilbert H. Hicks, U.S. Department of Agriculture, Washington, U.S.A. It has already reached vol. vi. and is illustrated.

WE understand arrangements are in progress, under the direction of Sir Howard Grubb, at the Rathmines Astronomical Works, Dublin, for a reflecting telescope, some ten feet in diameter, for the Paris Exhibition of 1900.

"THE PHOTOGRAM" for November has a beautifully illustrated article showing the uses of photography in the study of economic entomology. The examples are taken from various "Bulletins" of the Cornell University Agricultural Station, at Ithaca, U.S.A.

ONE is so accustomed to think of Linnæus as having belonged to a far bygone period that it is with some surprise we notice the death of his grandson, which took place last month in Paris, where he was the much-respected pastor of the French Lutheran Church.

THE "Report and Transactions of the South-Eastern Union of Scientific Societies," for 1898, has been received. It contains the papers read at Croydon Congress, with some illustrations. Abstracts from several of the papers have already appeared in these pages.

BRESLAUER AND MEYER, of Leipziger Str., 134, Berlin, have sent their beautifully produced and illustrated catalogue of scarce and valuable books of the 15th, 16th and 17th centuries. They chiefly apply to the science of archaeology and ancient religious writings.

THE "Quarterly Journal of the Astronomical Society of Wales" is to hand, but beyond a list of its members and some references to the November meteors, there appears to be little which has not appeared elsewhere. This number completes the first volume.

A MOVEMENT is on foot in Switzerland for the better enforcement of laws protecting wild birds. These regulations have fallen into abeyance in some cantons, though in others their beneficial results are notable by the abundance of bird-life where the feathered denizens were formerly scarce.

BY the death of the Rev. Thomas Nettleship Staley, D.D., formerly Anglican Bishop of Honolulu, there last month passed away one who took, while resident in the Hawaiian Islands, great interest in their geology. He lectured on the subject before the Royal Geographical Society, under the presidency of Sir Roderick Murchison.

MR. HENRY FFENNELL'S protest against the proposed dissolution of the Buckland Fish Museum at South Kensington, is loyal to his late friend, Frank Buckland, and energetic. Considering, however, its small scientific value, the space occupied by the Fish Museum could be well otherwise utilized.

THE Nottingham Natural Science Rambling Club concluded their tenth season on November 5th last by a conversazione which was numerously attended. The report read by Mr. W. Beckerton, the hon. secretary, was of a favourable character, there having been numerous excursions and lectures.

PROFESSOR VIVIAN LEWIS has entered upon an important series of Lectures at the Society of Arts upon "Acetylene Gas." The first took place on November 21st, and was largely attended by those interested in the new industry. The lecture was illustrated by a number of experiments of an entertaining character.

MR. HENRY STONE has been exploring the region around Great Slave Lake in North-West Canada. He specially went to investigate the mineral resources of the district, and is said to have found gold, mineral oil and natural gas in abundance. One place produced a quantity of that most beautiful mineral, peacock coal, which in the bright sunshine glistened like a fairy scene.

WE are glad to hear that "Natural Science" is to be continued. We understand its editorial department passes from London to Edinburgh, though the publishing office will remain here, but be transferred to the vicinity of St. Bartholomew's Hospital. The other journal to which we referred last month as likely to cease publication was "Science Progress." It is now announced that the last number completed its issue.

AT the meeting of the Geological Society at Burlington House on November 9th, Mr. Bauerman exhibited some specimens of iron ore from arctic Lapland. The ore is now largely exported to European iron-foundries. It was mentioned as an interesting geological fact that where the masses of ore outcrop in the marshes of that country, the western surfaces of the rock are smoothly polished by the fine particles of dust brought by the prevalent westerly Atlantic winds.

THE island of Anticosti, to which some exaggerated political importance has latterly been attached on account of its purchase by an eminent French commercial magnate, is an interesting hunting-ground for naturalists. At one time it was proposed to make it a reservation for the disappearing wild animals of Eastern Canada, but nothing came of the project. Probably someone remembered they could walk over to the mainland when the St. Lawrence was frozen in winter time, or the Labrador Indians could come over and hunt them.

THE "Proceedings of the South London Entomological and Natural History Society," Part i., 1898, is to hand. It contains several useful papers. One by Mr. J. W. Tutt, F.E.S., on "The Lasiocampides," is illustrated by two genealogical trees, to show the origin of these moths. Another useful paper is by Mr. Edward Saunders, F.L.S., F.E.S., on "Collecting British Hemiptera." Mr. South, F.E.S., read a paper on "The British Species of Lepidoptera occurring in Japan," and Mr. A. H. Jones, F.E.S., another on "Some South European Butterflies."

CONTENTS.

MICROSCOPY

CONDUCTED BY J. H. COOKE, F.L.S., F.G.S.

To whom Notes, Articles and material relating to Microscopy, and intended for SCIENCE-GOSSIP, *are, in the first instance, to be sent, addressed "J. H. Cooke, Edlestone, Battenhall Road, Worcester."*

CARBOLIC ACID A CLEARING AGENT.—Pure carbolic acid, says the "Journal of Applied Microscopy," has proved to be an excellent clearing agent for Polyzoa, parts of insects, vegetable tissues, etc. It does not render them brittle like some of the other agents. It should not be used where the details of very delicate tissues are sought, as the tissue is apt to shrink after being put in the balsam.

BACTERIA AND DUST.—A discovery that has an important bearing on the question of efficient disinfection has recently been made by Neisser, after prolonged research, on the dispersal of pathogenic organisms by means of minute currents of air below that of a sensible current. According to this eminent bacteriologist the bacilli of diphtheria, typhoid, plague, cholera and pneumonia are incapable of being carried as atmospheric dust.

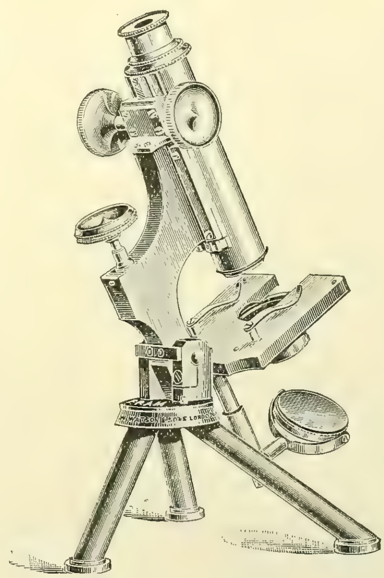
A WARY MICROBE.—The bacillus of whooping-cough, lately captured by Dr. Henry Koplik of New York, is extremely minute, the influenza germ being the only other bacillus as small. The whooping-cough bacillus usually resembles a club. After searching for it for five years, and finding it in the sputum of whooping-cough patients, the discoverer at last succeeded in making a culture of it by planting the sputum on human blood serum.

MICROSCOPICAL LECTURES.—The Manchester Microscopical Society, having decided to extend its scope, has recently formed a section for the purpose of giving lectures and demonstrations in biology and general microscopical work. A number of members have been selected as lecturers, who will, for travelling and out-of-pocket expenses, be prepared to give lectures, illustrated with specimens and lantern slides, to any society that may care to apply for their services. The list of subjects for lectures is a varied one, and will be forwarded to anyone interested on application to Mr. W. Stanley, 30, Lord Byron Street, Salford.

THE POSTAL MICROSCOPICAL SOCIETY.—We have been requested to inform our readers that the Postal Microscopical Society has entered on a new lease of life. A secretary has been found in the person of Miss F. Phillips, 3, Green Lawn, Rock Ferry, and it is expected that under her able guidance the society will become as flourishing as in the old days when the late Mr. Alfred Allen had control of affairs. Miss Phillips starts with one great advantage, she has the full confidence of the members of the society, which is still numerically strong, but its membership roll has somewhat suffered since the death of Mr. Allen. The secretary therefore appeals to all who are interested in microscopy—ladies or gentlemen—to send in their names to her for membership as soon as possible.

BACTERIOLOGICAL LABORATORY FOR LONDON.—The London County Council proposes to apply for Parliamentary powers to establish a bacteriological laboratory in London, where the medical officers of health and the medical practitioners in London could obtain, at the expense of the country, the services of competent bacteriologists. A similar institution was established in New York about five years ago and the result has been an unqualified success. It is to be hoped that the Metropolitan Vestries, in whose hands the matter now rests, will give the project their unanimous support and thus remove the stigma that at present attaches to the greatest city in the world.

A NEW MICROSCOPE.—Messrs. Watson and Sons of High Holborn, London, have just placed on the market a high-class microscope called the "Fram," which, though sold at the very moderate price of £4, possesses the advantages usually associated with the most expensive instruments. It has a



THE "FRAM" MICROSCOPE.

large spread tripod of seven inches and is so fitted that with the draw-tube closed it is suitable for continental objectives, and with it extended objectives corrected for the ten-inch tube can be used. The fittings are of "universal" size throughout, so that objectives, condensers and eyepieces of other makers can be employed. The excellence of the fitments and workmanship render this microscope specially suitable for all, whether specialist or amateur, who may require to carry on critical microscopical investigations of any kind.

RECENT RESEARCH.—Dr. K. Jordan contributes an article to the last number of "Novitates Zoologicae," the organ of the Tring Museum, in which he deals somewhat exhaustively with the phylogeny and classification of butterflies. His conclusions are largely based on the microscopic characters of the antennae scales, sense hairs, setiferous punctures and sense bristles in the various families of butterflies and moths. This branch of morphology has been greatly developed of late years, and the

literature on the subject grows apace. This latest addition marks a distinct advance, and it should therefore be read by all entomologists who are interested in the microscopic details of structure and the affinities of insects as determined by the structure of their organs.

A Finishing Cement.—In reply to T. W. W. Sheffield and others, a good cement varnish may be made by dissolving shellac in alcohol, and colouring it with aniline blue, red, etc.

A Cheap Slide Series.—Mr. F. Smith, of 15, Cloudesley Place, Islington, has sent us his list of micro-objects, together with a type series of slides. The objects are well mounted and very moderately priced.

Fossils in Amber.—More than 200 kinds of extinct life, microscopic and otherwise, including insects, plants, shells, fruit, reptiles, etc., have been found in amber. In an English collection, which is valued at £100,000, there is entombed a perfect lizard eight inches long.

The Microscope and Geology.—"Microscopical Light in Geological Darkness" formed the text of Professor E. W. Claypole's presidential address at the last meeting of the American Microscopical Society. After making out a strong case for the aid furnished by the microscope in geological study he proceeded to instance the remarkable discovery of the existence of innumerable inclusions of liquid carbonic acid in the rocks which was made by Dr. H. C. Sorby, of Sheffield. The investigations that followed on this discovery have shown that these bubbles of liquid gas are present "by myriads and by millions, and not in gems only, but in other crystalline minerals. In size they range between the one-thousandth and fifty-thousandth part of an inch, but they are so multitudinous as often to impart a white tint to the crystal, and many specimens of milky quartz owe their whiteness solely to the presence of these innumerable bubbles. In some of the Cornish granites the cavities make five per cent of the volume, and yield four pounds of the liquid to every ton of the rock." Mr. J. C. Ward is quoted as saying that more than a thousand millions of them might be contained easily within a cubic inch of quartz.

Origin of Coal.—Professor Claypole used this fact to discuss the problem of the origin of coal. Coal is derived from plants which have extracted carbon from the carbonic acid of the atmosphere. Whence was that carbonic acid derived? It has been said that it was one of the original constituents of the atmosphere; but Professor Claypole adduces many reasons to show that all the carbonic acid represented in the coal beds could never have been in the atmosphere at one time. How then and whence were the successive supplies introduced? The experiments of Dr. Sorby and of Professor Tilden have shown that from 1·3 to 17·8 of the bulk of most rocks consists of gases of which hydrogen and carbonic acid are the most abundant. Professor Claypole suggests that the carbonic acid used up in the formation of coal has been derived from the breaking up of the minute reservoirs of CO_2 which were contained in the immense volumes of the primary rocks that have been undergoing degradation from the commencement of the geological history of the world. Professor Claypole makes a brief calculation to show the amount contained in these wasted rocks is more than enough to account for all the coal known to exist.

GEOLOGY

CONDUCTED BY EDWARD A. MARTIN, F.G.S.

To whom all Notes, Articles and material relating to Geology, and intended for Science-Gossip, *are, in the first instance, to be addressed, at* 69, *Bensham Manor Road, Thornton Heath.*

Geological Society of London.—The Geological Society re-commenced its meetings on November 9th, when papers were read on the "Palaeozoic Radiolarian Rocks of New South Wales," by Prof. Edgeworth David, E. F. Pittman and Dr. G. J. Hinde. The first evidence of the presence of Radiolaria in the rocks of New South Wales was obtained by Prof. David in 1895, as the result of a microscopic examination of some red jaspers from different areas. The three chief areas of radiolarian rocks in New South Wales are Bingara, Barraba and Tamworth, situated in the New England District, between 180 and 270 miles to the north of Sydney. The fourth area of radiolarian rocks is at the well-known Jenolan Caves, about sixty-seven miles due west of Sydney and about 200 miles south-by-west of Tamworth. It is probable, according to present knowledge, that the Jenolan rocks may be on a somewhat different, perhaps lower, horizon than those of the northern district.

Radiolarian Rocks at Tamworth, N.S.W.—It is at Tamworth that the radiolarian rocks are developed on a grand scale; their measured thickness, after allowing for an immense fault, amounting to 9,267 feet, and neither upward nor downward limit is shown. The rocks consist of jointed claystones, black cherts, lenticular siliceous radiolarian limestones and coral-limestones. Numerous beds of submarine tuff also occur. The claystones are largely formed of Radiolaria. In certain beds of the claystones, and in some of the tuffs as well, impressions of *Lepidodendron australe* are not uncommon, and beds of radiolarian limestone occur in close proximity to the beds with these plant-remains, and Radiolaria, moreover, abound even in the same rock with the *Lepidodendron* impressions. The opinion is that the Radiolaria were deposited in clear sea-water, which, though sufficiently far from land to be beyond the reach of any but the finest sediment, was nevertheless probably not of very considerable depth.

Devonian Radiolaria of Australia.—In reporting on the Radiolaria in the Devonian rocks of New South Wales, Dr. G. J. Hinde found that in the chert and jasper rocks of the Jenolan, Bingara and Tamworth districts, the Radiolaria were for the most part in the condition of casts filled with chalcedonic silica and without structure, so that their generic characters could not be determined. However, in the siliceous limestones and in the volcanic tuffs, the Radiolaria were imbedded and infiltrated with calcite, and by careful etching of thin sections of the rock, the lime was eliminated and the organisms were shown very distinctly. The rock then appeared as a confused mass of entire and fragmentary Radiolaria and minute

débris of their spines and latticed tests. Fifty-four species belonging to twenty-nine genera have been determined and figured; all the species and four genera are regarded as new; excepting a few primitive types of Nassellaria, the forms belong to the Spumellaria. The large majority may be included in the Sphaeroidea and Prunoidea with medullary tests and radial spines. They do not show any near relationship to the Radiolaria described from Devonian rocks in Europe, but in some features they resemble the radiolarian faunas of Ordovician age in the south of Scotland, Cornwall and Cabrières, Languedoc. The large number of new species is accounted for from the fact that our knowledge of palaeozoic Radiolaria is very slight, and any fresh discovery of such rocks will no doubt materially increase our knowledge.

Radiolaria: Evidence of Deep-water Conditions. — In the discussion which followed the above-mentioned papers, Prof. Sollas combated the reasoning which took it for granted that because these organisms indicate deep-water conditions nowadays, the same thing held good in palaeozoic times. The Radiolaria are found in limestones, tuffs and claystones, and must have been in reach of the terrigenous deposits, *i.e.* within about one hundred miles of the shore. On the other hand, it was pointed out by Prof. Watts that if formed near the shore-line there would have been an intermingling of fossils of shore-loving forms. The only recognised fossils were corals, which occurred at the eastern end of the Tamworth section; besides which Radiolaria occurred in abundance even in the same rock with *Lepidodendron* impressions.

Geology of Birmingham and District.—The long excursion of the Geologists' Association took place this year in the district of Birmingham. The "Proceedings" just published contain the paper read by Prof. C. Lapworth, having special reference to the excursion. Prof. W. W. Watts adds a chapter on the petrology of the neighbourhood, whilst Mr. W. Jerome Harrison writes upon "The Ancient Glaciers of the Midland Counties of England." The work is illustrated by numerous photographic reproductions, and sections of various parts of Warwickshire and other counties. The papers deal with an area of about thirty-five miles on all sides of the city. In this region is found the entire geological succession between the pre-Cambrian and the Inferior Oolite. Although Ordovician strata are found only near the western edge of this area, they may have formerly existed within it. Pebbles of Ordovician rocks are occasionally met with in the Bunter pebble beds of the Midlands, with fossils of similar species to those of the arenaceous members of the Ordovician in Brittany and Normandy. Where the Old Red Sandstone outcrops in the western part of the district as a rule it retains its well-known Herefordshire characters. An interesting part of the paper is that which deals with the Archaean or pre-Cambrian rocks. We hear no more in our country of "Laurentian" rocks, the title of pre-Cambrian covering all such. That these ancient rocks probably underlie all the region under notice is shown by the discovery of isolated outcrops of them in some half-dozen places, where the overlying rocks have been swept away. They occur along the axes of the chief anticlinals, although they are of insignificant extent. Three of these areas of fundamental rocks include the highest points of the district. They are (1) the Malvern Hills, (2) the Wrekin Hills, and (3) Charnwood Forest. Besides these there are exposures at (4) Caldecote, to the east of Birmingham, and at (5) Barnt Green, to the south of Birmingham and at the south-eastern extremity of the Lower Lickey Hills. In regard to all these areas there is distinct stratigraphical proof that the beds are older than the Cambrian, except in the case of the Charnwood Rocks. These are surrounded on all sides by the Trias, but their lithological peculiarities ally them more to the Archaean rocks of the inliers already spoken of, than to any Cambrian or post-Cambrian rocks. The view of Prof. Bonney in regard to their age is almost universally accepted. The Charnwood Rocks are theoretically paralleled with the Lower Longmyndian and its volcanic equivalents, and the Caldecote rocks with the Upper Longmyndian and Uriconian. Prof. Watts points out that the Charnwood Rocks constitute the most easterly Archaean exposure known in Britain. He divides them into (1) the Brand Series, (2) the Maplewell Series, and (3) the Blackbrook series. Structure and petrology are the only guides to the age of the bedded rocks of the series. They have been much more affected by earth movements than have the Cambrian rocks of Nuneaton, and have little correspondence with the Uriconian rocks of Caldecote, the Lickey, and the Wrekin. It is likely, therefore, that they are distinct from, and older than, the Uriconian rocks. The Cambrian and Silurians are next dealt with in detail, after which follows a description of the Carboniferous rocks of the district. In dealing with the South Staffordshire coalfield, mention is made of the remarkable seam of coal known as the Ten-Yard Coal. This constitutes a workable bed of from twenty-five to thirty feet in thickness. To the south, beyond Halesowen, it thins out, and becomes mixed with shaly material. In reality composed of thirteen or fourteen superimposed coal seams, it appears at Essington and Pelsall as fourteen distinct coals, occurring at intervals in a thickness of 250 to 300 feet of sandy and shaly strata. So far as glacial geology is concerned, Mr. W. Jerome Harrison claims for the Midlands that they afford one of the most interesting fields of research in the British Isles. First, because three great glaciers met here, the Arenig, the Irish, and the North Sea (Scandinavian) Glaciers; second, the district contains examples of the terminal and lateral moraines, and also of the "fringe" of those glaciers; third, but little work has yet been done in tracing the courses and limits of these streams of ice. A large Arenig boulder lies in Cannon Hill Park, Birmingham, whilst Irish Sea Glacier boulders lie in amazing numbers in South Staffordshire and Shropshire, these consisting of Lake District rocks, Criffel granites, etc. In the neighbourhood of Wolverhampton the erratics are to be numbered by the thousand. The melting-point of this great glacier was probably along a line from Much Wenlock, Burton, Wolverhampton, Cannon Chase and Lichfield, in each of which places are found great concentrations of boulders. The North Sea Glacier is considered to be the one which, after depositing the Chalky Boulder Clay, reached as far as the north of London, boulders being found in the clay of Finchley, etc. The September, 1898, issue of the "Proceedings of the Geologists' Association of London" constitutes an excellent guide to the geology of Birmingham, and should be obtained by any readers interested in the district, as the information is trustworthy and the maps are well drawn.

NOTES & QUERIES

AGRIOLIMAX LAEVIS VAR. MACULATUS.—I see no reason to doubt that the "new variety" mentioned by Mr. G. E. Mason (*ante* p. 157) is in reality my *maculatus*. My original specimen may have been a little more spotted than those he has found, but there can be no essential difference. It seems possible, from what Mr. Mason says, that it may prove to be a distinct species. In that case those who hold extreme views about homonyms will probably want to rename it, as Simroth, in 1886 (SB. Ges. Leipzig, xii. pp. 11-12), called the *Amalia maculata* Heyn., *Agriolimax maculatus*. As a matter of fact, however, this latter slug is not an *Agriolimax*, but belongs to the genus *Lytopelte* Bttg. (*Platytoxon* Simr.). Still again, supposing the Barnes Common var. *maculatus* to be a distinct species, it will remain to prove that is not *A. lacustris* Bonelli, or *A. mentonicus* Nevill. *A. lacustris* certainly has the sub-aquatic habits of *maculatus*, but it presents some peculiarities not yet observed in the latter. No doubt Mr. Mason will in due time clear up all these questions.—*T. D. A. Cockerell, Mesilla Park, New Mexico, U.S.A.; October 24th.*

ELECTRICITY IN PLANTS.—Up to the present I have looked in vain through the columns of SCIENCE-GOSSIP for an accurate account of the remarkable phenomenon of the electrical display of light by plants under certain conditions. So far as my knowledge serves me, the phenomenon is occasionally exhibited by red and orange-coloured flowers, and more infrequently and less markedly by those of yellow tint. The manifestation seems dependent on an electrical condition of the air, and has only been observed after sunset, never during bright sunshine, in such plants as the marigold, the different species of poppy, the scarlet geranium, the heartsease, etc. Up to this point the facts noted in the case of the red Oriental poppy by Captain Cobbett (*ante* pp. 60, 125) agree, in so far as they concern that plant, with those just given. Thereafter, however, comes a difference. That observer states that the "scintillations" were of a bluish colour. I always understood that the light was of the same colour as the corolla of the plant from which it issued. I should be glad, therefore, if anyone possessed of fuller and perhaps more authentic information would correct any errors in, or add to, this brief note for the benefit of those who, like myself, may be desirous of learning more of this interesting phenomenon.—*Wm. Falconer*, 28, *Varley Road, Slaithwaite, Huddersfield.*

VESPA AUSTRIACA IN SCOTLAND.—A few weeks ago I received from Mr. John Mearns, Jasmine Terrace, Aberdeen, N.B., a small box of Vespae and a few other Aculeate Hymenoptera, with a request that I would name them for him, as he had just commenced their study and found considerable difficulty in determining the several species. This I was only too pleased to do. Amongst his Vespae was a very fine matured and somewhat wing-worn specimen of the female *Vespa austriaca* Panz. (*arborea* Smith), *ante* p. 69. It, however, somewhat differs from the normal form in that the three black dots on the disc of the clypeus have become spots, and the two lower ones united by a downwardly-curving somewhat jagged streak. It thus simulates the anchor-head termination of the mark as exhibited on the clypeus of the female *Vespa rufa*. The yellow of the abdomen is pure and unadulterated, and the hairs on the tibiae are abundant and long. With Mr. Mearns' permission I record his capture of this comparatively rare British wasp, of which he says: "*Vespa austriaca* was taken in the middle of May, 1898, in the suburbs of Aberdeen. I discovered and netted her on the trunk of a rotten tree, while searching for Diptera." The date of the capture, the bright colours and the somewhat worn condition of the wings, all point to its being a hibernated specimen that had been on the wing for some time. —*Charles Robson, Killingworth, Newcastle-on-Tyne.*

BOTANY OF MEDIÆVAL MONKS.—I think your correspondent, Mr. A. E. Burr (*ante* p. 188), will find an explanation of the peculiar interrupted pinnate condition of the sepals of *Rosa canina* in their mode of arrangement in the bud. The sepals there overlap one another in such a way that five margins are left free, while five are covered. The free margins are those which become pinnate; the others, owing to compression within the bud, are unable to develop in the same way. On reference to the accompanying diagram, where the figures show the succession from below upwards or from without inwards, it will be seen that owing to their

Diagram showing relative position of sepals of *Rosa* in the bud.

position, two sepals (1 and 2) will be lobed on both margins, two (4 and 5) will have no lobes at all, while one (3) will be lobed on its free margin and not on the one that is covered. The leaf-points to the sepals occur very commonly on several species of the allied genus *Rubus*.—*R. R. Hutchinson, Tunbridge Wells.*

ENTOMOLOGISTS' INTERNATIONAL EXCHANGE.—Like all entomologists, I have found some difficulty in obtaining specimens from foreign countries by means of exchange or purchase. I therefore suggest that an International Exchange Club should be formed in London by one of the several entomological societies, the organizing society to have correspondents in every part of the world; the duplicates sent in by members to be credited to them according to number and value. This would be determined by a committee of two or three members. Postage and other expenses should be paid by members who are exchanging. A subscription of, say, one pound sterling, would be ample, and would go also to cover rent of a suitable office or room in London for the purposes of the club, such as storage, cost of store-boxes, etc. I, for instance, have quantities of duplicates of all orders of South African insects, and should be glad to exchange them for English and Foreign Coleoptera. Should anyone take up the suggestion I should be pleased to act as hon. secretary for South Africa or, more especially, Cape Colony.—*Delancey Dods, P. O. Box* 634, *Cape Town.*

TRANSACTIONS

Royal Meteorological Society.—The opening meeting of the session was held on the evening of November 16th at the Institution of Civil Engineers, Great George Street, Westminster, Mr. F. C. Bayard, LL.M., President, in the chair. A report on experiments upon the exposure of anemometers at different elevations was presented by the Wind Force Committee. The experiments have been carried out by Mr. W. H. Dines and Captain Wilson Barker, on board H.M.S. "Worcester," off Greenhithe. Five pressure-tube anemometers were employed, the first being at the mizzen royal masthead, the second and third at the ends of the mizzen topsail yardarm, and the fourth and fifth on iron standards fifteen feet above the bulwarks. The results show that the ship itself affected the indications of the lower anemometers, while some low hills and trees, which are a quarter of a mile away from the ship to the south and south-west, also affected the wind velocity from those quarters. The Committee are of opinion that the general facts deducible from these observations bearing on the situation of instruments for testing wind force, are: (1) that they must have a fairly clear exposure to be of much value, and it would appear that for a mile at least all round there should be no hills or anything higher than the position of the instruments; (2) that on a ship the results may be considered fairly accurately determined by having the instruments fifty feet above the hull, but that on land it will generally be necessary to carry the instruments somewhat higher, to be determined entirely by the local conditions; (3) that no other form of anemometer offers such advantages as the pressure-tube, from the fact that it can be run up and secured easily at this height above a building, and that the pipes and stays can be slight, so as to offer no resistance to the wind or cause any deflecting currents. Captain D. Wilson-Barker read a paper giving the results of some observations which he had made on board ship with several hand anemometers with the view of comparing the estimated wind force with that indicated by instruments. Mr. W. Marriott exhibited some lantern-slides showing the damage caused by the tornado which burst over Camberwell about 9.30 p.m. on October 29th. The damage was confined to an area of about half a mile in extent, and within that space chimney-stacks were blown down, houses unroofed, trees uprooted and windows broken.

The South London Entomological and Natural History Society.—October 13th, Mr. J. W. Tutt, F.E.S., President, in the chair. Mr. Russell, "The Limes," Southend, Catford, was elected a member. Mr. Drury, F.R.H.S., presented a large number of Tortrices and Tineae to the society's collections. Messrs. Ashdown and Lucas presented numerous specimens of dragonflies. Mr. Moore exhibited a series of *Polia chi* from Yorkshire. They were taken at rest on dark stone-wall hedges, and were found most conspicuous, even from a distance. Mr. Fremlin, for Mr. Auld, eleven hybrids between *Pygaera curtula* and *P. anachoreta*, bred by Dr. Knaggs in April, 1898, together with typical specimens of both species for comparison. It was noted that the markings for the most part followed the female parent *P. curtula*. He also showed various races of *Tephrosia laricaria* and *T. biundularia*; a fine bred series of *Phorodesma bajularia* from the New Forest; specimens of *Zonosoma annulata* var. *obsoleta* from Devon; unusually dark forms of *Emydia cribrum*; a few *Eugonia autumnaria*, bred from a female taken at Folkestone; and a bred series of *Himera strigata* (*thymiaria*). Mr. Hall, two anastomised fruits of banana, which, however, had separate stems. Mr. Turner, a bred specimen of *Vanessa polychloros* from Horsham, much darker than usual and comparable to some of those produced by Mr. Merrifield's temperature experiments. Mr. Kaye, a Syntomid moth, *Macraeneme ladis*, from Venezuela, and a species of wasp which it mimicked. It had a remarkable development of the hairs on the long posterior legs. Mr. West, of Greenwich, specimens of the Hemipteron, *Ploiaria vagabunda*, from Reigate. Mr. Tutt read a paper entitled, "Scientific Aspects of Entomology."—*Hy. J. Turner, Hon. Report. Sec.*

City of London Entomological and Natural History Society.—Meeting, 18th October, 1898. Exhibits: Mr. Riches, a series of *Noctua ditrapezium* from larvae found at Hampstead Heath in the spring. This insect appears to be found in Surrey and Sussex, but is otherwise rare. Lewes and Tilgate Forest are known habitats; it is still found at Wimbledon, Richmond and West Wickham. Mr. Tutt said he had not known it to occur in Kent. Mr. H. May, larvae of *Agrotis corticea*, hatched from ova laid by a moth which he had taken early in the year at Sandown; they were feeding on potato and carrot. *Noctua c-nigrum*, a curious variety, in which the orbicular stigma could be distinctly traced as circular, and the white patch, of which the orbicular formed part, was squared at the base, instead of being roughly triangular; the transverse lines were more like those of *N. triangulum* than of *N. c-nigrum*. He also showed several *Leucania lithargyria*, much like *L. albipuncta*, also, for comparison, one of the latter species, which is a smaller and more delicate insect, the white spot being more sharply defined. Mr. Garland, a dark *Abraxas grossulariata*, of interest because captured, not bred. He took it at rest at Leyton, Essex. It was rather small, with a complete black outside border round fore- and hind-wings, which was very deep on the hind margin of the fore-wings, with two yellow spots on the costa of each fore-wing at the shoulders, the central white areas being sparingly dotted with black. He also exhibited some beautiful vars. (upper surface) of *Lycaena aegon*, from Westmoreland, with typical forms from Oxshott. Mr. E. H. Taylor, a long series of *Triphaena fimbriad*, bred from larvae taken at Wimbledon, including some green-shaded forms that occurred in about 40 per cent. of the imagines, pale forms 15 per cent., rich mahogany-brown forms 20 per cent., unicolorous 20 per cent., and undecided forms 5 per cent.; one specimen emerged very small in size. Mr. A. Bacot read a paper on "Nature," the term usually employed to refer to all animate and inanimate things that have not been disturbed by man. Though why London, the city of commercial speculation, gaiety and squalor should not be considered as much a natural object as a bird's nest or

an ants' hill, he had never been able to make out. He chose to understand "Nature" as including the whole of the impressions received by man from sources outside himself. He thought primitive man was greatly mistaken in his impressions about nature, but with the gradual development of his brain and the consequent growth of knowledge, theories had to be altered and brought up to his altered intelligence. Pagan mythology he looked upon as man's early theory of nature. As man's outlook continued to widen and clear his theory was altered or thrown aside for a new one, the old surviving as a mere legend. He objected to poetical descriptions of nature, which, if excusable in poetry, should be dropped out of prose. He objected to dealing with aught of which we had no knowledge. So-called "laws of nature" are scientific theories which, if with the lapse of ages they fail to explain all the phenomena they treat of to man's satisfaction, must be altered in detail or thrown aside. Euclid's axioms, Newton's law of gravitation and the Darwinian theory of the survival of the fittest seem now to be beyond the pale of doubt; but a time may come when they shall be cast aside with the other wreckage of the past. As to conscious "design in nature," and, therefore, a conscious author, in the same way that a conscious author may be predicated on looking at a machine or work of art, he thought there might possibly be a good deal of truth in the argument, but "granting that people are correct in arguing from a like effect to a like cause, where does it lead them to but back to man's brain, from which there is no escape?" "Man's brain is the designer," and the argument a paradox. Time and space are only modes of our perceptions. Atoms and molecules of the physicist, and the biophors and determinants of the biologist, are names for abstractions only, as purely ideal as lines of latitude and longitude, but useful to science. He did not want to deprecate our present knowledge, but to show it is subjective to man and that it must consequently alter with the alteration and development of his brain. Mr. Tutt thought that while some would agree others would disagree with many points brought forward by Mr. Bacot. A short discussion ensued.—Meeting, November 1st, 1898.—Exhibits: Mr. Tutt, on behalf of Mr. R. Gordon, insects from Wigtownshire, four female *Saturnia pavonia*, very variable in size, one with much red on hind-wing; two *Smerinthus populi*, one pale-fawn, the other pale-grey; three *Phalera bucephala*, one with right fore-wing dark; *Nemeophila russula*, hind-wings much suffused: five *Dasychira fascelina*, very variable as to the transverse lines just external to the discoidal spot; *Pharetra rumicis*, ab. *salicis; Craniophora ligustri*; *Taeniocampa incerta* (*instabilis*), including forms ab. *trigutta* Esp., *instabilis* Hb., and *virgata-brunnea*, Tutt; *Coenonympha typhon*, chiefly var. *rothliebi*, one with ocellated spots reduced; *Gnophos obscuraria*, small; *Cleora lichenaria*, well marked; *Pelurga comitata*, strongly banded. The interest in this exhibit is because, though many Perthshire and North Scotland insects are seen in London, it is more uncommon to see South Scotland forms. Dr. J. S. Sequeira: fine series of *Peronea christana*, with many of its numerous vars.; *Sericoris littorana;* several *Miselia oxyacanthae*, but not one of the dark var. *capucina; Xylina orniothopus* (*rhizolitha*); *Agriopis aprilina*, very green specimens; one *Sphinx convolvuli*, caught at bloom of tobacco plant. These were all taken on a recent visit to the New Forest. Mr. J. A. Clark: two beetles in amber from North Africa, and a dipteron in gum animi from Zanzibar. Also four interesting male *Bupalus piniaria* from Aberdeen. It is usually claimed that Scotch males are white, while South English are yellow in the central areas of the wings, this species affording an instance of dimorphism, the same occurring on the Continent, if Scandinavian insects be compared with South European. Of the four exhibited, one was yellow, one pale yellow, while the two others were remarkable for the smallness of the white patches, these being in one of the two, reduced to mere dashes. Mr. A. Bacot: a box of *Zygaena trifolii*, in broods of a series of years. They were variable in size, but did not show any decided distinctive difference in the broods. One was bred with a clear circular piece out of the right fore-wing. Mr. E. H. Taylor: a long series of *Leucania impudens*, taken near Putney. The species is generally considered a purely fen insect. These were paler than Wicken forms. The locality where they were captured is rather marshy, but a great part is fairly dry. Mr. Tutt said the insect was known to have occurred at Eltham. Mr. H. St. J. Donisthorpe: *Chyronomon vesparum*, a hymenopteron parasitic on wasps. It emerged from the abdomen of a wasp, which had a jelly-like appearance, the head and thorax being untouched. He also showed an ichneumon fly, at present unidentified, which has been parasitic on the parasite. Also *Ephialtes carbonarius*, an ichneumon parasitic on the longicorn beetle *Callidium violaceum*, and which was known to attack *Cerambyx heros, Oberea oculata* and *Saperda populnea*. In examining the borings of the beetle *C. violaceum*, he found a bee, *Chelostoma florisomne*, which had discovered and availed itself of them. Mr. Riches: blooms and seed-pods of the Cape-primrose, a species of *Streptocarpus* (nat. order, Gesneraceae) and native of Africa and Madagascar. The capsule is spirally twisted. Mr. F. B. Jennings: a box of Coleoptera, including *Zabrus gibbus, Carcinops 14-striata, Abraeus globosus, Otiorrhynchus raucus, Bagous argillaceus* and *B. limosus, Thryogenes nereis* and *T. scirrhosus, Phytobius notata* from Chatham; *Amara infima* and *Sitones griseus* from Woking; *Chilocorus similis* from Wicken; *Trachodes hispidus* from the Blean Woods, near Whitstable; and *Donacia thalassina* from Deal, the majority being this year's captures. Mr. Tutt read a paper on the "Metamorphosis of Insects." His first point was that metamorphosis took place after and not simultaneously with the first appearance of insects. He then spoke of the theory of metamorphosis. It was originally supposed that the caterpillar had within it "the germ of the future butterfly," throwing off a certain number of larval skins till it disclosed the pupa, and the pupal skin liberated the imago. Although certain facts appeared to lead to this view, riper and fuller knowledge led to Weismann's theory of histolysis, *i.e.* the complete destruction of the larval organs by a gradual process of degeneration, and the rebuilding, by a process of histogenesis, of the new material thus produced into the new organs, the *germs* of which he showed to exist within the organism. There appear to be imaginal discs or buds for each part of the body, and the process of histolysis and histogenesis is continuous throughout the life of the caterpillar, there being no sudden or sharp break from larva to pupa, or pupa to imago, which are external conditions only. As to the initial cause of metamorphosis, if there exist a period during which the insect can retire from its ordinary environment, already provided with an

abundant supply of stored food, and there undergo the changes, thus enabling it to take at once to a new environment, hiding itself at the most critical part of its life, it gives the metabolous insect an enormous advantage in its competition with other insects. It is even greater than that enjoyed by the merely winged insect over the apterous, there being winged insects before metabolous, and has ended in its becoming numerically the most successful type of life in existence. In the discussion which ensued, reference was made to the change to a putty colour undergone by *Cossus* at hibernation; and Mr. Dadd seemed to think that the pupal form, so similar in many cases, was more likely to indicate the primitive insect than the larval form.—*H. A. Sauzé, Hon. Sec.*

Lambeth Field Club and Scientific Society.—The twenty-seventh Annual Soirée and Exhibition of Natural History Specimens took place on October 24th, at the Lambeth Wesleyan Schools. The attendance was large, despite sharp showers at the time of commencement. The exhibits were very varied, conchology being well represented. Mr. Harvey-Piper delivered an exceedingly interesting ten minutes' chat on shells, and exhibited some splendid specimens of sea-melons and top-shells. The President's exhibit comprised land and fresh-water shells, including specimens of *Physa hypnorum* taken in a stream at Mitcham Common; also a reversed specimen of *Helix aspersa* taken in a garden at West Dulwich. Lepidoptera was represented by Messrs. Barker and E. J. Crow's collections, coleoptera by Mr. T. L. Barnett. In a collection of minerals by Mr. W. T. Howse were some fine specimens of copper ore from British Columbia. West Australian flowers and photographs by Mr. J. F. Bursill were very interesting. The Society's exhibit of fungi, owing to the prolonged drought, was this year very limited. The room containing the apparatus for demonstrating with Röntgen rays was filled during the greater part of the evening with persons anxious to see through their hands and arms. Thanks are due to Mr. Ettrick-Thomson for his treatment and explanations. Music and a humorous lecturette on "Zoomythology," by Mr. Yeatman-Woolf, formed part of the programme.

Greenock Natural History Society.—The twentieth annual meeting of this society was held on October 6th in the M'Lean Museum, Kelly Street, the President, Mr. M. F. Dunlop, in the chair. The report of the treasurer, showing the funds to be in a satisfactory state, was submitted and approved. The report of the secretary was also read and adopted. During the session 1897-8 five meetings were held, at which ten papers were read as follow: Mr. G. W. Niven, "Baron Munchausen's Mineralogical Discoveries in Scotland"; Mr. M. F. Dunlop, "Notes on a New Rotifer (*Metopidia pteryoida*)"; Mr. G. W. Niven, "Episodes in the History of 'Blackwood's Magazine'"; Mr. John Ballantyne, "The Hornet Saw Fly" and "Fern Structure"; Mr. M. F. Dunlop, Exhibit of Rotifers; Mr. H. D. Lusk, "Insect Structure"; Mr. T. Montgomery, "Solar Heat"; Mr. Thomas Rennie, "The Gyr Falcon"; and Mr. G. W. Niven, "The Arms, Standard, and Union Jack of the British Empire: a Suggestion for Colonial Representation." During the summer session an enjoyable excursion was made to Rothesay and Kilchattan Bay. The annual election of officers then took place for the year 1898-9.—*G. W. Niven, Hon. Sec., 23, Newton Street, Greenock.*

NOTICES OF SOCIETIES.

*Ordinary meetings are marked †, excursions *; names of persons following excursions are of Conductors.*

South London Entomological and Natural History Society.

Dec. 8.—†"Dragonflies." Lecture and lantern. W. J. Lucas, B.A.

1899.

Jan. 12.—†"Orthoptera." Stanley Edwards.
„ 26.—†Annual Meeting. Chair taken at 7 o'clock.

Tunbridge Wells Natural History and Philosophical Society.

Dec. 2.—†"Honeycombing and other forms of Weathering of Stone." Lantern. Geo. Abbott, M.R.C.S.

1899.

Jan. 12.—†"The Lances of Heaven." Lantern. Sir Robert Ball, F.R.S., LL.D. 3 p.m.
„ 20.—†"Timepieces—Created and Made." Mr. Herrmann.
Feb. 3.—†"The Fallaciousness of the Senses." Miss Cooke.
„ 17.—†Specimen and Microscopical Meeting. "Some Movements of Plants"; R. R. Hutchinson.
Mar. 8.—†"Wonders and Romance of Insect Life." Lantern. F. Enoch, F.L.S., F.E.S., F.R.H.S. 3 p.m.
„ 24.—†"The Chaldean Genesis." H. S. Roberton, B.A., B.Sc.
April 7.—†"British Vegetable Gall Formations." E. T. Connold.
„ 21.—†Specimen and Microscopical Meeting. "Insects' Metamorphoses," H. de C. Child.

Hon. Assist. Sec., R. R. Hutchinson, Belmont, Princes Street.

Selborne Society—Croydon and Norwood Branch.

Dec. 14.—†"Dogs and Dog Stories." Lantern. E. A. Martin, F.G.S. Temperance Hall, 6.30 p.m.

1899.

Jan. 15.—†"About Frogs and Toads." H. S. M. Grover. Telegraph Messengers' Institute, Upper Norwood, 8.15 p.m.
Mar. 23.—†"Birds and Bird Protection." E. A. Martin, F.G.S. Croydon Liberal Association Rooms, 8.30 p.m.
April —†Annual Meeting, 8 p.m. Lecture, 8.30 p.m.; Fred W. Ashley, F.Z.S.

Hull Scientific and Field Naturalists' Club.

Dec. 7.—†"Variation of Species in a State of Nature." W. Hewitt, F.E.S.
„ 21.—†"The Organization of an English Manor." J. R. Boyle, F.S.A.

1899.

Jan. 11.—†"Alpine Plants in a Highland Glen." Lantern slides. Rev. A. E. Shaw, M.A.
„ 25.—†"The Structure of Fishes." H. M. Foster.
Feb. 8.—†"Wireless Telegraphy," with Experiments. T. W. Ireland, M.A.
„ 22.—†"The Mosses of the East Riding." Lantern views. J. J. Marshall.
Mar. 8.—†"Shooting Stars." J. A. Ridgway.
„ 22.—†"Electrical Measurements," with Experiments. J. T. Riley, D.Sc., A.R.C.Sc.I.

The Meetings are held at 72, Prospect Street, Hull, at 8 p.m.
T. Sheppard, Hon. Sec.

Streatham Geological and Natural History Society.

Dec. 3.—†"On a Geological Trip from London to Brighton." J. P. Johnson.
„ 17.—†Annual Exhibition.

1899.

Jan. 7.—†"Some British Birds." G. White.
„ 21.—†"Geology of Caterham Valley." L. W. J. Costello.
Feb. 4.—†"The Inhabitants of a Pond." H. K. Hunter.
„ 18.—†"On the Excursion to Herne Bay." J. P. Johnson.
Mar. 4.—†Short Papers on Summer Excursions.

Hon. Sec., L. W. J. Costello, Callington, Stanhope Road, Streatham, S.W.

Yorkshire Naturalists' Union.

The date of the Annual Meeting at Scarborough has been altered to December 17th.

W. Denison Roebuck, Hon. Sec., 259, Hyde Park Road, Leeds.

Clapham Junction Y.M.C.A. Natural Science Circle.

Dec. 14.—†"The Occupiers of Space." C. Nicholson, F.E.S.
„ 28.—†"Art in Nature and Nature in Art." J. Miller-Carr.

1899.

Jan. 11.—†"The Microscope" and Microscopic Demonstration. Arthur Newton.
„ 28.—†"The Light of Olden Days." E. Lovett.
Feb. 8.—†Geological Lecture. Prof. J. Logan Lobley, F.G.S.
„ 22.—†"Interesting Features of Plant Life." Lime-light views. W. H. Griffin.
Mar. 8.—†Lecture on "Chemistry," with experiments. W. G. Whiffen, F.I.C., F.S.C.I.
„ 22.—†"South Africa." Lime-light views. Duncan Milligan, F.R.A.S.

April 5.—†' The position of Insects in regard to Man and their influences on Plants." A. Bacot.
Hon. Sec., F. W. Cannon, 1, Glycena Road, S.W.

LAMBETH FIELD CLUB AND SCIENTIFIC SOCIETY, St. Mary, Newington, Schools, Newington Butts, S.E.
Dec. 5.—†" Marvels of Pond Life." W. Tierney.
„ 17.—*Visit to Natural History Museum, Geological Department.
„ 19.—†Geological Notes by Members.

NORTH LONDON NATURAL HISTORY SOCIETY.
Dec. 1.—†" Solitary Bees and Wasps." W. H. Smith.
„ 15.—†General Business.
Visitors will be cordially welcomed at all meetings and excursions. *Lawrence J. Tremayne, Hon. Sec.*

GEOLOGICAL ASSOCIATION OF LONDON.
Dec. 2.—†" Contributions to the Geology of the Thame Valley." A. M. Davies, A.R.C.S., B.Sc., F.G.S.

METROPOLITAN SCIENTIFIC SOCIETIES.

The following is a list of societies in the London district devoted to natural science, with hours and places of meeting. They may be visited with introduction from a Fellow, Member, or Secretary. Will secretaries send additions or corrections.

ANTHROPOLOGICAL INSTITUTE OF GREAT BRITAIN, 3, Hanover Square. Second and fourth Tuesdays at 8.30 p.m., November to June.

BATTERSEA FIELD CLUB AND LITERARY AND SCIENTIFIC SOCIETY. Public Library, Lavender Hill, S.W. Thursdays, 8 p.m.

CITY OF LONDON COLLEGE SCIENCE SOCIETY, White Street, Moorfields, E.C. Last Wednesday in each month, October to May, 7.30 p.m.

CITY OF LONDON ENTOMOLOGICAL AND NATURAL HISTORY SOCIETY, London Institution, Finsbury Circus. First and third Tuesdays, 7.30 p.m.

CLAPHAM JUNCTION NATURAL SCIENCE CIRCLE, Young Men's Christian Association Rooms, Battersea Rise, S.W. Alternate Wednesdays, 8 p.m.

CONCHOLOGICAL SOCIETY, LONDON BRANCH, St. Peter's Rectory, Walworth. Irregular meetings. Rev. J. W. Horsley, President, will answer enquiries.

CROYDON MICROSCOPICAL AND NATURAL HISTORY CLUB, Public Hall. Third Tuesdays, October to May, 8 p m.

DULWICH SCIENTIFIC AND LITERARY ASSOCIATION. Fortnightly lectures Lordship Lane Hall, second and fourth Mondays, 8.15 p.m., from October, for winter season.

EALING NATURAL SCIENCE AND MICROSCOPICAL SOCIETY. Victoria Hall, Ealing. Second and last Saturdays. October to May, 8 p.m.

ENTOMOLOGICAL SOCIETY, 11, Chandos Street, Cavendish Square. First Wednesday, October to June (except January). Third Wednesday, January, February, March and November, 8 p.m.

GEOLOGISTS' ASSOCIATION, University College, Gower Street. First Friday, 8 p.m., November to July.

GEOLOGICAL SOCIETY OF LONDON, Burlington House, Piccadilly. First and third Wednesdays, 8 p.m., November to June.

GREENHITHE NATURALISTS' AND ARCHÆOLOGICAL SOCIETY, 7, The Terrace. First Fridays, 7 p.m.

LAMBETH FIELD CLUB AND SCIENTIFIC SOCIETY, St. Mary, Newington, Schools, Newington Butts, S.E. First Mondays all the year and third Mondays in winter, 8 p.m.

LINNEAN SOCIETY OF LONDON, Burlington House, Piccadilly. First and third Thursdays at 8 p.m., November to June.

LONDON AMATEUR SCIENTIFIC SOCIETY, Memorial Hall, Farringdon Street, E.C. Fourth Friday in each month, October to May, 7.30 p.m.

LUBBOCK FIELD CLUB. Working Men's College, Great Ormond Street, Bloomsbury, W.C. Excursions second Sundays, Meetings following Mondays, 8 pm.

MALACOLOGICAL SOCIETY OF LONDON, meets in Linnean Society's Rooms, Burlington House. Second Friday each month, November to June, 8 p.m.

MINERALOGICAL SOCIETY. Meets in rooms of Geological Society, February 4th, April 14th, June 23rd, November 17th, 8 p.m.

NONPAREIL ENTOMOLOGICAL AND NATURAL HISTORY SOCIETY, 99, Mansfield Street, Kingsland Road, N.E. First and third Thursdays, 8 p.m.

NORTH KENT NATURAL HISTORY AND SCIENTIFIC SOCIETY. St. John's Schools, Wellington Street, Woolwich. Alternate Wednesdays, 7.30 p m.

NORTH LONDON NATURAL HISTORY SOCIETY, Sigdon Road Boys' Board School, Dalston Lane, Hackney Downs Station. First and third Thursdays, 7.45 p.m.

QUEKETT MICROSCOPICAL CLUB, 20, Hanover Square. First and third Fridays, 8 p.m.

ROYAL BOTANIC SOCIETY OF LONDON, Regent's Park. Second and fourth Saturdays at 3.45 p.m.

ROYAL HORTICULTURAL SOCIETY, 117, Victoria Street, S.W. Second and fourth Tuesdays, except December to February; 2 p.m. on show days, which vary.

ROYAL METEOROLOGICAL SOCIETY, 22, Great George Street, Westminster. 3rd Wednesday, November to June, 8 p.m.

ROYAL MICROSCOPICAL SOCIETY, 20, Hanover Square. Third Wednesdays, October to June, 8 p.m.

SELBORNE SOCIETY, 20, Hanover Square. Meetings and rambles are arranged by the various local branches.

SIDCUP LITERARY AND SCIENTIFIC SOCIETY, Public Hall. Sidcup. First and third Tuesdays, October to May, 8 p m.

SOUTH LONDON ENTOMOLOGICAL AND NATURAL HISTORY SOCIETY, Hibernia Chambers, London Bridge, S.E. Second and fourth Thursdays, 8 p.m.

SUTTON SCIENTIFIC AND LITERARY SOCIETY, Public Hall Chambers. Second and forth Tuesdays, 8 p.m.

WEST KENT NATURAL HISTORY, MICROSCOPICAL AND PHOTOGRAPHIC SOCIETY. Meets in School for Sons of Missionaries, Blackheath, third Wednesday, in December, fourth Wednesdays in October, November, January, February, March, April, May, 8 p.m.

ZOOLOGICAL SOCIETY OF LONDON, 3, Hanover Square. First and third Tuesdays, 8.30 p.m., November to August.

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TO CORRESPONDENTS AND EXCHANGERS.—SCIENCE-GOSSIP is published on the 25th of each month. All notes or other communications should reach us not later than the 18th of the month for insertion in the following number. No communications can be inserted or noticed without full name and address of writer. Notices of changes of address admitted free.

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NOTICE.—Contributors are requested to strictly observe the following rules. All contributions must be *clearly* written on one side of the paper only. Words intended to be printed in *italics* should be marked under with a single line. Generic names must be given in full, excepting where used immediately before. Capitals may only be used for generic, and not specific names. Scientific names and names of places to be written in round hand.

THE Editor will be pleased to answer questions and name specimens through the Correspondence column of the magazine. Specimens, in good condition, of not more than three species to be sent at one time, *carriage paid*. Duplicates only to be sent, which will not be returned. The specimens must have identifying numbers attached, together with locality, date and particulars of capture.

THE Editor is not responsible for unused MSS., neither can he undertake to return them, unless accompanied with stamps for return postage.

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WANTED, foreign shells, crustaceans, echinoderms. Offered, sea-fan (Rhipidogorgia occatoria), New Zealand echinoderms, British crustaceans and echinoderms, whole and half-plate photo-micrographic negatives.—H. W. Parritt, 8, Whitehall Park, N.

OFFERED, good botanical microscopical slides in exchange for well set Lepidoptera or living ova or pupae.—John Collins, 201, Green Lane, Birmingham.

OFFERED, SCIENCE-GOSSIP (bound), 1868-69. Wanted, "Journal of Conchology," vols. v. vi. and vii.; also Mr. Lionel Adams' latest book.—G. Breeden, 304, St. Vincent Street, Ladywood, Birmingham.

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